COMPREHENSIVE STREAM AND WETLAND MONITORING, RESTORATION AND MITIGATION FRAMEWORK

Mountain Valley Pipeline Project

Prepared for:

Mountain Valley Pipeline, LLC
2200 Energy Drive, 2nd Floor
Canonsburg, Pennsylvania 15317

Prepared by:

Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE
Charleston, West Virginia 25304
Phone: (304) 342-1400 Fax: (304) 343-9031
Email: potesta@potesta.com

In collaboration with:

Tetra Tech, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive, Suite 100
Gainesville, Virginia 22055

Project No. 0101-21-0244-005

November 9, 2021

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COMPREHENSIVE STREAM AND WETLAND MONITORING, RESTORATION AND MITIGATION FRAMEWORK

Mountain Valley Pipeline Project

1.0 INTRODUCTION

Mountain Valley Pipeline, LLC (Mountain Valley) is seeking an Individual Permit (IP) for the Mountain Valley Pipeline Project (the Project) from the United States Army Corps of Engineers (USACE) Pittsburgh, Huntington, and Norfolk Districts to conduct regulated activities in navigable waters under Section 10 of the Rivers and Harbors Act of 1899 and for the discharge of dredged and fill material into "Waters of the United States" (WOTUS) under Section 404 of the Clean Water Act (CWA). In addition to the USACE IP application, Mountain Valley is seeking CWA Section 401 Water Quality Certification from the West Virginia Department of Environmental Protection (WVDEP) and the Virginia Department of Environmental Quality (VADEQ) for portions of the Project within their respective jurisdictions.

This Comprehensive Stream and Wetland Monitoring, Restoration and Mitigation Framework (Mitigation Framework) was prepared jointly by a team of experts from Potesta & Associates, Inc.; Tetra Tech, Inc.; and Wetland Studies and Solutions, Inc. at Mountain Valley's request in response to comments from the U.S. Environmental Protection Agency (USEPA) and other parties on Mountain Valley's IP application. Although the application reflected a robust suite of stream and wetland monitoring, restoration, and mitigation measures, those measures were dispersed among various existing regulatory documents and actions proposed in the application and may not have been readily apparent to many commenters. Furthermore, Mountain Valley carefully reviewed the comments by USEPA and others to determine if additional reasonable and prudent actions could be taken to improve the Project's approach to stream and wetland monitoring, restoration, and mitigation. A significant set of additional voluntary measures were developed as a result of that review and further consultation with USACE, WVDEP, and VADEQ. The Mitigation Framework does not replace the mitigation that is required for permanent fills but is a voluntary proffered supplement for temporary impacts associated with the Project.

The purpose of this document is to consolidate the Project's proposed stream and wetland monitoring, restoration, and mitigation measures into a comprehensive framework and to outline a systematic approach to verifying that the impacts to jurisdictional aquatic resources, both wetlands and streams, associated with the construction of the Project are appropriately mitigated. This Mitigation Framework incorporates the following elements, each of which is attached hereto, to meet these objectives:

A. Baseline Assessment Plan
B. Restoration Work Plan
C. Performance Standards

D. Monitoring Plan
E. Maintenance & Adaptive Management Plan
F. Supplemental Credit Determination Methodology

The Baseline Assessment Plan identifies metrics for each stream and wetland. Those metrics are tracked and utilized in the other elements of the Mitigation Framework. For example, the stream survey information collected under the Baseline Assessment Plan is used to restore streams under the Restoration Work Plan. The information is then used to define the restoration success criteria in the Performance Standards which, in turn, are monitored under the Monitoring Plan. If restoration is not proceeding as intended, the survey information will inform the measures to be taken under the Maintenance & Adaptive Management Plan. The relationships between the metrics are summarized in the Mitigation Framework Process Summary table on the following page. The numbering system in the table is consistent through each plan element to show the metrics' relationships through the restoration process.

Mountain Valley Pipeline – Baseline Assessment Plan, Restoration Work Plan, Performance Standards, Monitoring Plan, and Maintenance & Adaptive Management Plan Process Summary

	A. Baseline Assessment		B. Restoration Work Plan	C. Performance Standards	D. Monitoring Plan	E. Maintenance & Adaptive Management Plan	F. Supplemental Credit Determination Methodology (Temporary Impacts)
	Metric	**Source**			**(annually for 3 years post restoration)**		
1.00	**Wetlands - Attributes**						
1.0.1	Cowardin Classification	Project Delineation Report and related PJD Table 3 in IP Application	Varies by location in ROW[1] Construction procedures to support reestablishment of PEM characteristics. Hand plantings in accordance with mitigation requirements and Restoration and Rehabilitation Plan	Temporary impacted wetlands will progress to a PEM system at maturity. PFO systems will have bare-root saplings planted with a required success rate of 400/acre	Wetland Determination Forms[2] to be completed per each monitoring event. Stems per acre to be counted in year 1 and 2 and thereafter if not met.	For all: (a)Check soil fertility, pH, organic matter percentage, and Density (b) Correct any issues found in (a) and then replant/reseed during appropriate timeframe (c)Or if no issues found - then replant/reseed during appropriate timeframe (d) Failure after 3 annual attempt – may pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	In WV, the SWVM forms will be used to calculate temporal impacts at a standard 3% per year. In VA, the USM forms will be used to calculate temporal impacts at a standard 3% per year. **Temporary wetland impacts associated with pipeline installation:** PEM wetland vegetation is expected to return within one full growing season. To conservatively compensate for any lingering temporal loss following restoration of the wetland crossing, an additional two years of compensatory mitigation will be provided (6% total). **Temporary wetland impacts associated with temporary fill placement:** The duration of the assumed construction impact will extend from the date of the installation until the date it is removed, plus an additional two years to remain consistent with the pipeline temporary impacts. No additional compensatory mitigation is proposed for restoration of PSS or PFO vegetation because, as discussed in Section 3.2 (Appendix F), compensatory mitigation has already been provided for those conversion impacts.
1.0.2	Wetland Area	Project Delineation Report and related PJD	Existing topographical surveys and field delineations	Restored wetland area shall be greater than or equal to the original wetland area	Delineated[2] and survey located to compare to pre-crossing area.	Evaluate wetland area; Regrade/reseed if necessary; if cannot achieve original size pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	
1.0.3	Topographical Survey	Existing topographical surveys and field delineations	Existing topographical surveys and field delineations	Return as close as practicable to the preconstruction contours to maintain original wetland hydrology	As-built survey to compare to pre-crossing area.	Evaluate wetland area; Regrade/reseed if necessary; if cannot achieve original size pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	
1.0.4	Dominant Vegetation	Vegetation Strata - Wetland Determination Data Forms	Restoring upper 12 inches of pre-segregated topsoil with wetland seedbank. Seeding if necessary.	More than 50% of all dominant herbaceous plant species shall be facultative (FAC) or wetter (facultative wetland (FACW) or obligate wetland (OBL).	Vegetation Strata - Wetland Determination Data Forms[2]	See 1.0.1	
1.0.5	Invasive plant species cover	Vegetation Strata - Wetland Determination Data Forms	Manual removal of invasive plant species.	less than 5% coverage	Vegetation Strata - Wetland Determination Data Forms[2]	Remove with Herbicides if approved, or mechanical/hand weeding	
1.0.6	Native (non-invasive) herb Vegetation Coverage	Vegetation Strata - Wetland Determination Data Forms	Restoring upper 12 inches of pre-segregated topsoil with wetland seedbank. Seeding if necessary.	Plant coverage shall be at least 70% unless shrub and/or canopy/crown coverage is at least 30%.	Vegetation Strata - Wetland Determination Data Forms[2]	Same as section 1.0.1	

A. Baseline Assessment		B. Restoration Work Plan	C. Performance Standards	D. Monitoring Plan	E. Maintenance & Adaptive Management Plan	F. Supplemental Credit Determination Methodology (Temporary Impacts)
Metric	**Source**			**(annually for 3 years post restoration)**		
1.0.7 Hydric Soils	Hydric Soil Indicators - Wetland Determination Data Forms	Restoring upper 12 inches of pre-segregated topsoil.	Presence of positive indicators of hydric soil formation	Hydric Soil Indicators - Wetland Determination Data Forms2	If positive indicators of hydric soils cannot be identified, pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	
1.0.8 Hydrology Indicators	Wetland Hydrology Indicators - Wetland Determination Data Forms	Re-establish original surface hydrology and contours to maintain overland flow patterns	Presence of Group A Hydrology Indicators or the presence of other hydrologic indicators as listed on the Wetland Determination Data Forms	Wetland Hydrology Indicators - Wetland Determination Data Forms[2]	Check precipitation data for drought indices. If it is determined that drought conditions are present, additional actions are not required. If drought conditions do not exist, the following measures will be considered: regrading, redirecting overland flow and/or installing groundwater monitoring wells. If efforts to restore hydrology are not achieved pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	
1.0.9 Bulk Density	N/A	Standard decompaction practices (disking, plowing, cultivating, tilling, or incorporation of organic matter into the topsoil horizon)	N/A	N/A	If standard decompaction practices have not sufficiently de-compacted the soil, then bulk density testing may be completed for the topsoil.	
1.1 Wetlands - Resource Valuation						
1.1.1 WV SWVM	Assessment using Delineation Report and Data sheets	N/A	N/A	N/A	N/A	

A. Baseline Assessment			B. Restoration Work Plan	C. Performance Standards	D. Monitoring Plan	E. Maintenance & Adaptive Management Plan	F. Supplemental Credit Determination Methodology (Temporary Impacts)
Metric		Source			(annually for 3 years post restoration)		
2.0	**Streams - Attributes**						
2.0.1	Stream Survey Stream Cross Section Area (including) Pool to pool spacing Max pool depth Average riffle slope Average reach slope Pebble count	Longitudinal surveys of field conditions, cross-section analysis, and in-stream surveys	Restore segregated native stream substrate; Restore according to pre-crossing cross-sectional and longitudinal profiles, cross-sections and visual assessments.	Stream Cross Sectional Area: No increase or decrease of >25% of baseline (Perennial); Restored to stable configuration (Ephemeral and Intermittent) Pool to Pool Spacing: No increase or decrease of >25% of baseline pool to pool range Max Pool Depth: No increase or decrease of >50% of baseline (Perennial); Restored to stable configuration (Ephemeral and Intermittent) Average Reach Slope: No increase or decrease >10% Average Riffle Slope: No increase or decrease >10% Pebble Count: Maintain Category	Longitudinal surveys of field conditions, cross-section analysis, and in-stream surveys. Longitudinal and cross-section surveys will be completed for the first year only unless conditions indicate additional surveys are required.	For all: (1) If monitoring indicates that success criteria issues are caused by deficiencies in adjacent ROW - correct issue (2) If caused by offsite watershed changes (outside of Mountain Valley's Control) - propose site specific stabilization plan to USACE, WVDEP, VADEQ and implement if approved; (3) Pursue potential Credits/ ILF (subject to the approval of the USACE, WVDEP, VADEQ)	In WV, the SWVM forms will be used to calculate temporal impacts at a standard 3% per year. In VA, the USM forms will be used to calculate temporal impacts at a standard 3% per year. Temporary stream impacts associated with pipeline installation: Mountain Valley will include one year of compensatory mitigation from the date the stream is impacted (3% total) Temporary stream impacts associated with temporary fill placement: The duration of the assumed construction impact will extend from the date of the installation until the date it is removed, plus an additional one year to remain consistent with the pipeline temporary impacts.
2.0.2	Stream Vegetation	Visual Assessment; See Section 2.1.5	Reseeding as per FERC and state requirements; hand planting in PFOs and site specific locations.	Monitor for a stable 70% herbaceous vegetative cover of the riparian buffer and 70% survival of woody stems. Less than 5% coverage by invasive species	Visual Assessment and photo collection	(1) Check soil fertility, pH, organic matter percentage, and density (2) Correct any issues and then replant (3) If no issues found - replant/reseed; or (4) Coordinate with the agencies to determine if the riparian area is detrimental to the resource restoration and if additional mitigation credits or appropriate ILF contributions are required	
2.1	**Streams - Resource Valuation**						
2.1.1	Field water quality						
a	-Dissolved Oxygen	Field Assessment using YSI water quality meter or similar	Removing instream diversions to restore stream flow to channel.	Meet the baseline conditions or the minimum state water quality standards	Field Assessment using YSI water quality meter or similar	Consult with Agencies to address differences, if any, as watershed/time of year and precipitation will change many of	

A. Baseline Assessment			B. Restoration Work Plan	C. Performance Standards	D. Monitoring Plan	E. Maintenance & Adaptive Management Plan	F. Supplemental Credit Determination Methodology (Temporary Impacts)
Metric		Source			(annually for 3 years post restoration)		
b	-Specific conductivity		Removing instream diversions to restore stream flow to channel.	Within the range of 0-1,500 uS/cm (typical range of freshwater resources in the ecoregion)		these measurements. Adaptive management actions may range from (a) additional monitoring (to see if the changes are just temporal), (b) additional plantings, (c) adding woody debris, (d) implementing stream structural changes, (e) translocating benthics with habitubes (if appropriate), and/or (f) the purchase of additional credits or ILF contributions.	
c	-pH		Removing instream diversions to restore stream flow to channel.	Meet the baseline conditions or the state water quality standards			
2.1.2	Rapid Bioassessment Protocol (RBP)	Field Assessment using Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (RBP) data collection forms	Restore segregated native stream substrate; Restore according to pre-crossing cross-sectional and longitudinal profiles, cross-sections and visual assessments.	Starting with 1st year post construction, continued or maintained scores during Monitoring Period.	Field Assessment using Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (RBP) data collection forms		
2.1.3	Benthic Macroinvertebrates	Field Assessment in accordance with WVDEP Watershed Assessment Branch Standard Operating Procedures and EPA RBP Methodologies		N/A. Data collection only.	Field Assessment in accordance with WVDEP Watershed Assessment Branch Standard Operating Procedures and EPA RBP Methodologies		
2.1.4	HGM Assessment	Field Assessment according to EPA Hydrogeomorphic Protocol		Starting with 1st year post construction, continued or maintained scores during Monitoring Period.	Field Assessment according to EPA Hydrogeomorphic Protocol		
2.1.5	Visual Assessment Documentation	Field Pictures	N/A	Utilized for visual comparison	Repeat Field Pictures per protocol	Utilized for visual comparison	
2.1.6	WV SWVM	Field Assessment using Hydrogeomorphic Approach	N/A	N/A	N/A	As appropriate, Mountain Valley and the applicable agencies may use the data summarized in the baseline WV SWVM assessment in the AMP decision- making process	
2.1.7	USM	Field Assessment to assign a Reach Conditions Index (RCI)	N/A	N/A	N/A	As appropriate, Mountain Valley and the applicable agencies may use the data summarized in the baseline WV SWVM assessment in the AMP decision- making process	

[1]Planting required in select location – see plan

[2]USACE 1987 *Wetland Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* Version 2.0 (USACE, 2012)

2.0 BASELINE ASSESSMENT PLAN

The Baseline Assessment Plan (**Appendix A**) was developed to supplement and, in some cases, update the information presented in the IP application. It relies on a broad suite of assessment and monitoring methods that, in concert with the existing information in the application, will provide a detailed picture of each stream and wetland crossing included in the application.

Gathering appropriate baseline data about each proposed stream and wetland impact is valuable for several purposes, including: characterizing the resource and the nature of the impact to the resource, developing appropriate mitigation measures, guiding the post-construction restoration of impacts, and assessing whether the resources have been successfully restored. The Baseline Assessment Plan was prepared to ensure that Mountain Valley and the relevant regulatory agencies (USACE, WVDEP, VADEQ) have adequate site-specific information for each temporary impact to fulfill the goals and objectives of the Mitigation Framework. The pre-crossing information collected pursuant to this Baseline Assessment Plan also may provide additional support for the factual determinations the USACE must make under 40 C.F.R. § 230.11. Data collected under the Baseline Assessment Plan will be provided to the USACE, WVDEP, and VADEQ under separate cover.

3.0 RESTORATION WORK PLAN

The Restoration Work Plan (**Appendix B**) provides a comprehensive picture of the stream and wetland construction and restoration procedures to be employed on the Project. The Restoration Work Plan serves two purposes. First, it consolidates various existing construction and restoration procedures into one document. Second, it outlines how the elements of the Mitigation Framework will be implemented in the field during the post-construction restoration of temporarily impacted streams and wetlands.

The Project is subject to rigorous impact restoration requirements imposed by federal and state agencies acting within their respective jurisdictions, which are consolidated in the Restoration Work Plan. As detailed in the Federal Energy Regulatory Commission (FERC *Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement* (FEIS) issued on June 23, 2017, Mountain Valley agreed to adopt the FERC's general construction, restoration, and operational mitigation measures outlined in the FERC *Upland Erosion Control, Revegetation and Maintenance Plan* and the FERC *Wetland and Waterbody Construction and Mitigation Procedures*. Project construction activities also must adhere to state requirements for pipeline construction. In West Virginia, the Project's stormwater discharges are regulated by a Water Pollution Control General Act Permit for construction authorization and site-specific Erosion and Sediment Control Plans (ESCPs) approved by the WVDEP. In Virginia, Project construction must comply with Mountain Valley's *Annual Standards and Specifications* site-specific ESCPs and site-specific post-construction stormwater management plans approved by the VADEQ.

In addition to consolidating the restoration requirements noted above, the Restoration Work Plan documents how the site-specific data gathered through the Baseline Assessment Plan will be used by environmental work crews in the field to restore the impacted resources. It further explains how the post-construction restoration activities will foster attainment of the performance standards prescribed for restored streams and wetlands.

4.0 PERFORMANCE STANDARDS

Immediately after construction, temporarily-impacted streams and wetlands will be restored, and restored resources will be monitored and maintained based on established performance standards. Performance standards are a defined set of measurable goals for restored streams and wetlands that can be evaluated through post-restoration monitoring. The performance standards utilized here are based on mitigation guidance developed by the respective USACE districts. If a restored resource is not meeting one or more performance standards during the monitoring period, targeted maintenance and/or adaptive management actions will be taken. Restoration of a stream or wetland will be considered successful when post-restoration monitoring demonstrates that the resource has met all relevant performance standards.

Performance Standards for assessing the successful restoration of stream and wetland impacts are documented in **Appendix C**.

5.0 MONITORING PLAN

Mountain Valley will conduct post-restoration monitoring of each restored stream and wetland in accordance with the Monitoring Plan in **Appendix D**. The Monitoring Plan is designed to ensure that all necessary data are collected to evaluate whether restored resources are meeting the defined performance standards. If the performance standards are not being met, data collected under the plan also will be used to determine what Maintenance & Adaptive Management Plan actions should be implemented to achieve a successful restoration. It is anticipated that the monitoring period will last up to three years unless relevant performance standards have been met sooner and the agencies agree that restoration has been achieved. If the relevant performance standards at a particular monitored site have not been met after three years, a plan for corrective actions which may include continued monitoring, will be submitted to the relevant agencies for approval.

To maintain clear communication with the agencies, Mountain Valley will submit annual monitoring reports to the appropriate USACE district and the relevant state agency, WVDEP or VADEQ, that address the previous year's monitoring activities. Each annual report will include:

- All data collected for each restored stream and wetland site in accordance with the Monitoring Plan;
- Any findings that warrant action under the Maintenance & Adaptive Management Plan and, if necessary, a corrective action plan based on those findings; and

- Recommended determination of whether each monitored site has achieved the applicable performance standards or if additional monitoring is required.

6.0 MAINTENANCE & ADAPTIVE MANAGEMENT PLAN

Mountain Valley's Maintenance & Adaptive Management Plan is attached as **Appendix E**.

6.1 Maintenance

Mountain Valley will conduct annual inspections of the restored aquatic resources for the timeframes prescribed in the Monitoring Plan. This includes inspections for the presence of invasive plant species in restored wetlands. Restoration areas will be maintained and repaired as needed during the monitoring period to meet the objectives of this Mitigation Framework as well as other regulatory requirements.

During the post-restoration monitoring period, Mountain Valley will conduct maintenance as required for all related erosion and sediment control and stormwater management permits issued for this Project. Additionally, as monitoring indicates, any and all maintenance actions needed shall be implemented promptly, such as invasive-species controls, reseeding/replantings or soil modifications, subject to growing season and as weather conditions allow.

6.2 Adaptive Management

Aquatic ecosystems are complex and dynamic entities which will often respond to natural and anthropogenic disturbances in a unique, watershed-specific manner. Adaptive management, which is often referred to as "learning by doing," is a problem-solving environmental management approach for learning through deliberately designing and applying management actions as experiments. Adaptive management is a very useful tool that emphasizes the critical role of ongoing monitoring and evaluation. Adaptive management is a cyclic process where one assesses, designs, implements, monitors, evaluates, and adjusts as projects progress.

If an annual monitoring event identifies a stream or wetland that is not meeting the performance standards, Mountain Valley will utilize adaptive management principles to develop a plan for remedial action. The proposed plan, including a description of the corrective actions and a timeline to implement them, will be included in the annual monitoring report submitted to the USACE, WVDEP, and VADEQ for review. If necessary, corrective actions and any associated supplemental monitoring may extend beyond the three-year post-construction monitoring period.

If Mountain Valley determines that adaptive management has not been and is not likely to be successful in fully restoring an impacted resource, it may propose – subject to approval by the USACE and relevant state agency, WVDEP or VADEQ – that additional compensatory mitigation credits or in-lieu-fee (ILF) payments be provided. This backstop measure provides assurance that there will be no net loss of aquatic resources.

7.0 SUPPLEMENTAL CREDIT DETERMINATION METHODOLOGY

The compensatory mitigation plan included in the IP application complied with the 2008 Compensatory Mitigation Rule (33 C.F.R. Part 332 & 40 C.F.R. §§ 230.91-230.98) and applicable regulations in Virginia and West Virginia. As stated in the application, compensatory mitigation has been provided for all permanent impacts in the form of mitigation bank or ILF credits in appropriate ratios, and restoration was proposed as a primary form of compensatory mitigation for temporary impacts. In consideration of the comments on the application, Mountain Valley developed the Supplemental Credit Determination Methodology in **Appendix F**.

The Supplemental Credit Determination Methodology outlines a proposal to provide voluntary supplemental compensatory mitigation for *each* temporary stream and wetland impact. To determine the quantity of supplemental mitigation credit, Mountain Valley identified the expected duration of each temporary impact associated with Project construction – which includes the time from when the impact first occurs until it is restored. Because resources are not likely to meet the Performance Standards immediately after they are restored, Mountain Valley added one year of additional compensatory mitigation to stream impacts and two years to wetland impacts. Building on a methodology developed by the West Virginia Interagency Review Team, Mountain Valley proposes to provide supplemental compensatory mitigation at a rate of 3% per year for projected period of potential impact (i.e., sum of direct impacts during construction and post-construction restoration period). This approach to supplemental compensatory mitigation exceeds the applicable federal and state regulatory requirements and the standard practices in each of the respective USACE districts. Most importantly, this proposal provides additional assurance that the goal of "no net loss" will be achieved – if not result in a *net lift* in aquatic resources.

8.0 REFERENCES

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National Oceanic and Atmospheric Administration (NOAA). 1999. *Discounting and the treatment of uncertainty in natural resource assessment.* NOAA Damage Assessment and Restoration Program, NOAA. Washington, DC. Available online at https://casedocuments.darrp.noaa.gov/northeast/athos/pdf/NOAA%201999.pdf

USACE and VADEQ, January 2007. Unified Stream Methodology for Use in Virginia. U.S. Army Corps of Engineers, Norfolk District and Virginia Department of Environmental Quality. 37 pp.

Appendix A:

BASELINE ASSESSMENT PLAN

Mountain Valley Pipeline Project

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APPENDIX A:

BASELINE ASSESSMENT PLAN

Mountain Valley Pipeline Project

Every stream and wetland proposed to be temporarily impacted in the IP application will be evaluated in accordance with this Baseline Assessment Plan.

1.0 WETLANDS – ATTRIBUTES

Wetland evaluations will be completed on all planned wetland crossings (Table 3 of the IP Application) using the West Virginia Stream and Wetland Valuation Metric (WV SWVM) evaluation. Please note that field evaluations are not necessary to complete the WV SWVM evaluation for wetland impacts and will only require desktop analysis utilizing the previously prepared and USACE approved aquatic resources delineation data for this project; the WV SWVM forms can be generated for wetlands based on existing acreages and wetland type information.

1.0.1 Cowardin Classification

All wetlands that are proposed to be temporarily impacted in the application will be classified by their respective Cowardin classifications (Cowardin et al., 1979) using data from the project delineation report (**Attachment I** of the IP application) and its related Preliminary Jurisdictional Determination (PJD) issued by the USACE.

1.0.2 Wetland Area

The area of all wetlands that are proposed to be temporarily impacted or have been temporarily impacted under prior issued permits is provided in the IP application, which will be the source of information for this baseline metric.

1.0.3 Topographical Survey

Existing topographical surveys used in the Project's construction plans and lidar data will be utilized as the Baseline Topographical survey for wetlands areas. Additionally, wetland boundaries mapped during delineation efforts will also be used.

1.0.4 Dominant Vegetation

Existing Wetland Determination Data Forms from the project delineation report and its related PJD will be referenced to determine existing dominant vegetation in wetlands that are proposed to be temporarily impacted or have been temporarily impacted under prior issued permits.

1.0.5 Invasive Species Cover

Existing Wetland Determination Data Forms from the project delineation report and its related PJD will be referenced to determine the prevalence of invasive species cover in wetlands that are proposed to be temporarily impacted.

1.0.6 Native (Non-Invasive) Herbaceous Vegetation Coverage

Existing Wetland Determination Data Forms from the project delineation report and its related PJD will be referenced to determine native (non-invasive) herbaceous vegetation cover in wetlands that are proposed to be temporarily impacted.

1.0.7 Hydric Soils

Existing Wetland Determination Data Forms from the project delineation report and its related PJD will be referenced to determine the presence of hydric soils in wetlands that are proposed to be temporarily impacted.

1.0.8 Hydrology Information

Existing Wetland Determination Data Forms from the project delineation report and its related PJD will be referenced to determine hydrology information in wetlands that are proposed to be temporarily impacted.

1.0.9 Bulk Density

Bulk density for baseline assessment assumptions is assumed not to exceed root growth restriction ranges and thus will not be measured during the baseline assessment. Bulk density may be measured during restoration if the Lead Environmental Inspector determines it is necessary or as part of the adaptive management strategy.

1.1 WETLANDS – RESOURCE EVALUATION

1.1.1 WV SWVM

Wetland valuations will be conducted using the WV SWVM methodology. Additional detail on that methodology can be found in Section 2.1.6.

2.0 STREAMS – ATTRIBUTES

2.0.1 Stream Survey

Longitudinal profile surveys and cross-sections will be confirmed or completed to document stream pattern (sinuosity), profile (habitat types, riffle-run-pool), and dimension (cross-sections) within the limits of disturbance (LOD) as established by the existing perimeter controls, using modern survey techniques (with a Trimble, Leica, or similar unit) to collect data as described below. The longitudinal profile will be used to identify individual bed features, their maximum depth, bed feature spacing, and bed feature slope. This will provide information on the stream's morphology, including the presence of riffles, runs, and pools within the LOD (excluding areas that are inaccessible due to worker safety concerns). A reach-wide, representative pebble count is being utilized for these surveys. This information, along with the longitudinal profile and cross-sections, will be entered into RiverMorph, Excel, or CADD software and will represent the baseline conditions for each crossing.

Please note that it may not be possible to collect these data at every crossing; when that occurs, best professional judgment will be utilized to determine how to proceed. In these instances, additional photo documentation may be necessary (beyond what is required in Table 4), and the field notes will include a detailed explanation as to why data could not be collected as per these methodologies. Please also note that civil surveys were previously completed for a portion of stream crossings in both West Virginia and Virginia and will be included in this assessment. Thalweg points and/or cross section data points may only need to be collected for these crossings in West Virginia and Virginia.

Survey procedures:

1. Collect adequate mapping for field survey. Identify a distinct starting point for mapping that will be easy to correlate in the field. If practicable, use mapping to determine approximate slope of stream segments and whether valleys are confined. Use checklist for field equipment (**Exhibit A**).

2. Where practicable, field observations should only be made during normal flow conditions. High flows will remove bed features and produce inaccurate designations. Low flow or non-normal no flow conditions make it difficult to assess transition points and stream types that are found in the lower portions of the continuum. Proceeding under these conditions should be done with extreme care and only by more experienced investigators. Additionally, data should be flagged as being obtained during low flow.

3. The starting point in the field will be mapped with a GPS unit and marked with surveyor's flagging.

   Longitudinal profiles are measured in a downstream direction. An elevation measurement should be taken at major breaks in the bed topography. Four types of features are measured at each station, unless one or more features are not present: thalweg (deepest part of the channel), water surface, edge of water on both banks, and the top of both banks. The thalweg and water surface measurements should reflect bed elevation and water surface slope changes as the stream progresses through a bed feature sequence (e.g., rifle, run, pool, glide). Note position of cross-section locations along the profile). This information should also be stored in the Trimble, Leica, or similar unit.

The information from the longitudinal profile will be used to develop plan and profile views of the stream facets as well as potential special aquatic sites, such as riffle:pool complexes.

Diagnostic features of channel types and discussions regarding riffle:pool complexes are shown in **Table 1**.

Table 1 - *Diagnostic Features of Each Channel Type*

	Colluvial	Cascade	Bedrock	Step:pool	Plane-bed	Pool:riffle	Dune:ripple
Typical bed material	Variable	Boulder	Rock	Cobble-boulder	Gravel-cobble	Gravel	Sand
Bedform pattern	Variable	Random	Irregular	Vertically oscillatory	Featureless	Laterally oscillatory	Multilayered
Dominant roughness elements	Grains	Grains, banks	Boundaries (bed and banks)	Bedforms (steps, pools), grains, barks	Grains, banks	Bedforms (bars, pools) grains, sinuosity, banks	Sinuosity, bedforms (dunes, ripples, bars) grains, banks
Dominant sediment sources	Hillslope, debris flows	Fluvial, hillslope, debris flows	Fluvial, hillslope, debris flows	Fluvial, hillslope, debris flows	Fluvial, bank failure, debris flows	Fluvial, bank failure	Fluvial, bank failure
Sediment storage elements	Bed	Lee and stoss sides of flow obstruction	Pockets	Bedforms	Overbank	Overbank, bedforms	Overbank, bedforms
Typical confinement	Confined	Confined	Confined	Confined	Variable	Unconfined	Unconfined
Typical pool spacing (channel widths)	Unknown	<1	Variable	1 to 4	None	5 to 7	5 to 7

Taken from Montgomery and Buffington, 1997

In addition to the longitudinal profile, the reach will be visually inspected for potential riffle:pool complexes that are consistent with the Montgomery and Buffington definition of this feature (**Exhibit B, Figure 1, Photo D**). Specifically, riffle:pool complexes are characterized by sinuous or meandering platforms that contain riffle, pools, and bars (**Exhibit B, Figure 2(D)**) (Chartrand and Whiting, 2000). Leopold et al. (1964) defined pool:riffle complexes as undulating beds that have defined sequences of bars, pools, and riffles or predictable sequences of these stream units. Pools are topographical depressions within the channel, while bars are corresponding high points (**Exhibit B, Figure 3(D)**) (Montgomery and Buffington, 1997). In this channel type (self-formed pool:riffle channels), riffles will be spaced about every five to seven channel widths. The exception to this may be channels that have large amounts of woody debris. These channels have low to moderate gradients (See **Exhibit B, Figure 4**) and are typically unconfined and have a well-developed floodplain. Chartrand and Whiting (2000) reported a median slope for this channel type of 0.0060 and a range of 0.001 to 0.015, while Montgomery and Buffington (1997) found that streams with slopes less than 0.02 were generally composed of pool:riffle channel units (**Exhibit B, Figure 4**). The substrate in these types of channels may vary from sand to cobble, but gravel is the dominant substrate type. If noted as potentially present, these locations will be marked with GPS and within the longitudinal survey. Additional evaluations may be completed to determine if a complex is truly present. Photo documentation will also be completed.

Three cross-sections should be completed, one within the boundaries of the crossing, and in one riffle and one pool, if there is available habitat (this may vary of a site-by-site basis). This will allow for stream classification, as needed, and will provide baseline channel dimensions. The method is summarized as follows:

a. Set up the surveying instrument in a location where the entire cross-section can be viewed. The instrument should be placed in an elevation higher than the highest feature required for the survey.
b. Obtain rod readings at major breaks in bed elevation and key features, such as left edge water, thalweg, and right edge water. Also record top of bank and toe of bank.

Pebble counts will be completed in the right-of-way (ROW). Pebble counts characterize the channel and bed material present through a given study reach. A representative reach-wide pebble count is used to determine stream type, while an active riffle pebble count is used for hydraulic calculations. Because this baseline assessment is not being used for hydraulic calculations, a reach-wide, representative pebble count is being utilized for these surveys. Pebble count instructions are as follows:

a. Pace the entire study reach; estimate and record pool lengths and riffle lengths.
b. Calculate the percentage of the reach composed of pool and riffle bed features.
c. Identify bankfull on both sides of the channel at the first cross-section (transect) location and determine the sampling interval (sample at equal increments across the entire channel).
d. Begin the pebble count below bankfull. Do not include particles if the channel width is small (based on best professional judgement), as 20% of the samples (2 out of 10) may skew the particles that make up the boundary of the channel. Unless conditions dictate otherwise, a 5% bank sample is taken (one sample every other transect). To avoid bias of selecting larger particles, the observer should look away from the channel bed and select the first particle touched by the tip of the index finger at the observers' toe.

e. Measure the length of the B-axis in millimeters. If the particle is linear shaped, average the A-, B-, and C-axes.
f. Continue until 10 particles from 10 different cross-sections (transects) have been measured in proportion to the bed features of the reach.

The methods for longitudinal profiles, cross-sections, and pebble counts are similar to those found in Rosgen's River Stability Field Guide (2008) but have been updated for use with modern survey techniques. Use of data sheets similar to those found in Rosgen publications is being recommended but is not required.

4. As noted, the survey should proceed in a downstream manner. In a headwater reach, the survey should start at the point where the limits of jurisdictional waters have been identified. In some instances, it may be practical to identify valley type upslope of this point.

5. Upon completion of survey, materials should be copied, and the originals should be placed in the project's main file. Photographs should be uploaded on to the server and identified. Information regarding longitudinal profile and cross-sections will be entered into CADD software. A report should be developed including mapping that identifies each channel (stream) reach type and information supporting this designation, which may include photographs and measurements taken in the field.

Please note that Mountain Valley's environmental inspection team conducts a detailed inspection of every aquatic resource immediately prior to the start of construction. As part of those inspections, data collected from the pre-crossing longitudinal surveys, cross-sections, and photographs will be evaluated to determine if there has been a substantial shift in the streambed morphology at each of the crossings between the date the preliminary survey was conducted and the date of the crossing. Evaluations may include, but are not limited to, the assessment of potential changes to elevations in riffles and to top of riffle locations. In the event a substantial shift in streambed morphology is noted during a pre-construction inspection, the environmental inspection team will delay construction of the crossing until a revised longitudinal profile survey and cross section can be prepared.

6. The survey data collected above will be summarized into the following metrics for comparison to performance standards in future monitoring events:

a. *Stream cross-sectional area*. The survey data will be used to compute the area of each cross-section from the substrate surface to a plane that coincides with the lowest significant change in bank slope. This plane elevation will be utilized in all future monitoring events for each particular cross-section.
b. *Pool-to-pool spacing*. Will be determined from the longitudinal survey.
c. *Max. pool depth*. Will be determined from the cross-sectional survey.
d. *Average riffle slope*. Will be determined from the longitudinal survey.

e. *Average reach slope*. Will be determined from the longitudinal survey.

f. *Pebble Count*. D_{50} will be determined by the pebble count information collected.

2.0.2 Stream Vegetation

Existing stream vegetation will be noted during initial field assessments of each proposed temporary impact and will be captured in the visual assessment documentation as further described in Section 2.1.5.

2.1 STREAMS – RESOURCE VALUATION

Specific data-collection methodologies are outlined in the following Sections

Please note that Mountain Valley has a limited ability to conduct activities outside of the LOD approved by the Federal Energy Regulatory Commission. Accordingly, field-data-collection activities will be limited to the specific LOD width for each crossing and require a modification from the standard reach lengths as outlined in both the U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (RBP) Manual (100-meter reach for RBP/Benthic Macroinvertebrates) and the Hydrogeomorphic (HGM) Protocol (suggested 100-foot [ft] reach) and applicable state guidance. The assessment reach will be limited to the 75-ft LOD or less, depending on the proposed impact type (pipeline crossing, temporary or permanent access road, additional temporary workspace, or anode bed). Depending on the crossing angle, stream meanders, and other factors, the actual length of the stream reach available for survey within the LOD may be more or less than 75 ft.

Mountain Valley proposes to will conduct preliminary assessment and survey activities of streams that are proposed to be temporarily impacted in the IP application presently pending before the USACE (**Table 2, IP Application**). If new or modified temporary impact locations are proposed, or previously proposed temporary impacts are slated to be avoided, the survey locations will be adjusted accordingly.

Each proposed temporary stream crossing will be assessed and surveyed for parameters prior to the proposed temporary impact, unless doing so proves impracticable or unsafe. Impracticable conditions that may limit data collection would include a dry stream channel, which prevents the collection of benthic, field water quality, and several of the RBP assessment parameters. Adverse weather conditions and/or hazardous site access or stream access conditions due to existing conditions and/or precipitation could prevent crews from completing required sampling activities. Sampling will only be conducted if travel and site conditions are safe for the field crew(s) collecting the data. Safety assessments will be completed by field crews upon traveling to and arriving on-site. Please note that based on topography along the LOD, some sites along sections of the Project that have not been prepared for construction may require strenuous hikes with equipment that would prove unsafe due to steep hillsides and/or steep stream banks. Field crews are advised to not conduct sampling if access conditions to the crossings or stream crossing conditions are determined to be unsafe. Weather or flow conditions could potentially affect the total number of sampling events required to obtain the recommended data. In the event impracticable or unsafe conditions prevent the collection of any data, the crew will utilize data previously collected by Mountain Valley, if relevant data are available. Any data gaps resulting from impracticable or unsafe conditions will be noted in the final report.

2.1.1 Field Water Quality

Water-quality data will be collected concurrently with the biological and physical data using the WVDEP's Watershed Assessment Branch Standard Operating Procedures (WAB SOP) (WVDEP, 2018). Field water-quality parameters will include dissolved oxygen, specific conductivity, and pH per the WV SWVM form. Field water-quality parameters will be collected both at the upstream edge of the pipeline LOD and the downstream edge of the pipeline LOD. Downstream edge LOD water-quality data will be input into the WV SWVM form. Stream flow (velocity and depth measurements) will also be documented at each crossing location, unless water flow is absent, is too low to obtain measurements, or presents high-flow (flooding) conditions that would endanger the survey crew or that would provide data indicative of high-flows rather than normal flows. WVDEP WAB SOP or USEPA Environmental Monitoring and Assessment Protocol (EMAP; Lazorchak et al., 1998) methods will be utilized for collecting stream-flow measurements.

More detailed information on how these samples are to be collected is available in the WVDEP WAB SOP, Chapter 2. Prior to the site visit, meters will be calibrated at least weekly as per the manufacturers' specifications and calibration records will be retained. Probes will be inspected for potential wear, and membranes will be replaced as necessary. Field data will be collected in an area with adequate depth and flow near mid-stream or in the thalweg.

The data collected above will be summarized into the following metrics for comparison to performance standards in future monitoring events:

1. Dissolved oxygen
2. Specific conductivity
3. pH.

2.1.2 Rapid Bioassessment Protocol (RBP)

For consistency between West Virginia and Virginia, Mountain Valley will utilize the widely accepted USEPA RBP data collection forms provided in **Exhibit C (Data Forms)** for both RBP scoring and benthic macroinvertebrate sampling. Habitat assessments will be completed as outlined in the USEPA RBP Manual (Barbour et al., 1999), with a modified reach length to be applied based on specific ROW crossing width. The USEPA's RBP stream physical characterization field sheets will be completed for each stream crossing. The results of the visual-based habitat assessment will be used to determine the quality of habitat for the overall aquatic community at each sampling location. Weather conditions prior to and during sample collection will also be noted. Sampling locations will be documented with Trimble GPS units or similar equipment, capable of sub-meter accuracy. Stream measurements and velocity data will be taken at a representative location within the sampling reach to calculate stream-flow data during each sampling event. These methods may also be found in Chapter 5 of the RBP Manual (Barbour, et al., 1999). Field forms are included in **Exhibit C**. Stream-velocity readings will also be recorded to calculate stream flow during each benthic macroinvertebrate sampling event. Methods are available in the WVDEP WAB SOP, Chapter 4.

Please note that, for streams without stream flow, a modified RBP will be completed, and the HGM assessment will need to be completed (Refer to Section 2.1.6). The following categories related to stream flow are not recorded on the RBP form when the stream channel lacks flow:

1. Epifaunal substrate/available cover,
2. Velocity/depth regime,
3. Channel flow status, and
4. Frequency of riffles/or bends.

These modifications are listed in the WV SWVM form instructions (Cells D15-D25) for high-gradient ephemeral streams (USACE, 2011).

2.1.3 Benthic Macroinvertebrates

Mountain Valley will utilize methodologies outlined in the WVDEP WAB SOP and USEPA RBP manual, with a modified reach length to be applied based on the constraint of working within the site-specific LOD crossing widths. Single-habitat (kick net) samples will be collected. As per the methodology, samples will be collected using a rectangular dipnet (four-kick composite). Samples will be field sieved, composited, preserved, and returned to a third-party laboratory for processing. Samples will be hand-picked, and organisms will be identified to the family level (when possible) using appropriate taxonomic keys with a target of 200 organisms [200 (+/- 20 %) sub-sample]. The multi-metric West Virginia Stream Condition Index (WVSCI) (Gerritsen, et al., 2000) will be generated from the single habitat data. The WVSCI results in a score for each site ranging from 0 to 100, which is then used by the WVDEP to indicate stream condition or levels of impairment. A more detailed description of this methodology can be found in Chapter 5 of the WVDEP WAB SOP and Chapter 7 of the RBP Manual (Barbour et al., 1999). Information regarding WVSCI scoring is available in Chapter 5, Section E, Part 2 of the WVDEP WAB SOP (WVDEP, 2018).

Benthic macroinvertebrate samples will be collected and sent to a third-party laboratory for sorting, enumeration, and identification. Crews will collect photos (Refer to **Table 3** for Photo Requirements) and complete appropriate field forms and documentation during sampling events. Field data will be entered into Excel workbooks and the data summarized. The benthic macroinvertebrate data will be scored using an Access database provided by the West Virginia Division of Natural Resources, with this information also being entered into Excel workbooks. Summarized data will then be analyzed and presented in a report that discusses the findings of the assessment.

Acceptable collection dates in West Virginia are from April 15 to October 15 unless a deviation is approved by the agencies. This is the timeframe of the data that were used to develop the WVSCI, and any sampling event outside of this window is considered not comparable. Acceptable collection dates in Virginia are from September 1 to November 30 (fall monitoring period) or March 1 to May 31 (spring monitoring period), with a two-week buffer in Virginia between seasons to account for seasonal uncertainties and improve assessment performance provided that there are not excessively high or low flows. Benthic macroinvertebrate samples will only be collected at sites meeting the sampling requirements in the WVDEP WAB SOP habitat protocol. If stream conditions are unsafe or pose a hazard, samples will not be collected. Furthermore, streams should not be sampled after extended dry periods unless the wetted channel width is known. This helps avoid collection of misrepresentative stream condition data due to the lack of colonization in dry streambeds. Please note that if ephemeral and/or intermittent streams are dry and/or there are drought conditions, or if perennial streams are dry during site visits, available data will be collected and notations will be made in site notes documenting the on-site conditions and inability to collect certain data types (water quality and benthics). Samples should also not be collected after a high-flow event (48 hours after a scouring event).

The WVSCI score determined by the methodology above will be used for comparison to performance standards in future monitoring events.

2.1.4 HGM Assessment

USACE developed the HGM assessment guidebook to assess the ecological performance of high-gradient headwater streams and low-gradient perennial streams within the reference domain of eastern Kentucky and western West Virginia and the expanded reference domain including much of the Appalachian Plateau within Tennessee, Ohio, Pennsylvania, and Virginia (Summers, et al., 2017). The assessment protocol is utilized in headwater (ephemeral and intermittent) streams with channel slopes greater than 4% and in perennial streams with a channel slope <4% that are safely wadeable and are "shadeable" (narrow enough that the potential exists for full tree canopy closure over the channel).

Variables utilized for headwater (ephemeral and intermittent) stream subclass (Summers, et al., 2017) include:

1. Channel canopy cover
2. Channel substrate embeddedness
3. Channel substrate size
4. Channel bank erosion
5. Large woody debris
6. Riparian/buffer zone tree diameter
7. Riparian/buffer zone snag density
8. Riparian/buffer zone sapling/shrub density
9. Riparian/buffer zone vegetation species richness
10. Riparian/buffer zone soil detritus
11. Riparian/buffer zone herbaceous cover
12. Watershed land-use

Variables utilized for the perennial stream subclass (Summers, et al., 2017) include:

1. Channel canopy cover
2. Channel substrate embeddedness
3. Channel substrate size
4. Channel bank erosion
5. Large woody debris
6. Percent forest
7. Riparian/buffer zone tree diameter
8. Coefficient of conservation

Data collected during the HGM assessments are input into the appropriate Excel version of the forms, which generates the Functional Capacity Index (FCI) scores based on the data that were input. The FCI is a score ranging from 0 to 1.0, which indicates the capacity of a stream to perform ecological processes relative to the reference standard sites. Specifically, the FCI will evaluate hydrology, biogeochemical cycling, and habitat within the stream corridor.

An example of the FCI Excel forms is available in **Exhibit D**.

Please note that based on the limited assessment reaches (75-ft ROW or less), standard modifications were made to the HGM assessment methods to address recurring conditions at stream crossings, such as timber mat bridges and culverts. General modifications are as follows:

1. Stream Assessment Reach (SAR) Length and Increments

a. As the HGM methodology lists the SAR at a recommended 100-ft length for ephemeral and intermittent streams, SAR length and increments of samples will be scaled back proportionately to fit within the LOD. The calculator generates the same FCI scores as long as the data are proportional. This helps to address the issue of the reduced SAR lengths due to abnormal conditions listed below and LOD width. This proportional reduction also solves the issue of collecting the standard amount of data points for a 100-ft reach in a drastically-reduced assessment reach within the LOD as proper spacing may not always be available.

i. For instance, in a 75 ft ROW, with an approximate 25 ft timber mat bridge, the approximate SAR would be 50 ft (See 2. Timber mat Bridges below). Rather than collect the total number of increments or total data points for variables as indicated for a 100-ft reach, half that number would be collected as the SAR has been reduced by half the recommended length. Example: V_{EMBED} and $V_{SUBSTRATE}$. 15 equidistant points in a 50-ft SAR (rather than 30). Or 8 points (rounded up from 7.5) for a 25-ft SAR.

ii. For simplicity, the following table illustrates the modifications for specific variables, based on SAR length:

ED_006496_00000033-00026

Table 2: HGM High-Gradient Assessment SAR Length and Variable Increment/Data Point Modifications

Variables	25' SAR (10' to 29')	50' SAR (30 to 54')	75' SAR (55 to 79')	100' SAR (80' and up)
1 – $V_{CCanopy}$	3 equidistant points	5 equidistant points	8 equidistant points	10 equidistant points
2/3 – V_{Embed} and $V_{Substrate}$	8 particles – collect 4 every 10 ft	15 particles – collect 5 every 10 ft	24 particles – collect 4 every 10 ft	30 particles – collect 3 every 10 ft
10/11 – $V_{Detritus}$ and V_{Herb}	1 plot per bank	2 plots per bank	3 plots per bank	4 plots per bank

2. **Timber Mat Bridges**
   a. Timber mat bridge areas will be documented with the site sketches (RBP forms) and photos and excluded from the SAR.
   b. If the bridge splits the channel (i.e., ≥10 ft on one side and ≤40 ft on the other side) both the upper and lower sections should be included within the SAR. If a portion of the reach is less than 10 ft, it does not allow adequate space for assessment and will be excluded from the SAR.

3. **Culverts and Access Road Timber Mats**
   a. ROWs often have existing culverts or access road timber mats, prohibiting collection of HGM variables (or any other parameters – WQ/RBP/Benthics) within the ROW. Existing culverted crossings or access road timber mats will be documented with the site sketches and photos and excluded from assessment.

4. **Large Woody Debris (LWD)**
   a. Some stream crossings may have excessive riparian growth (briars/willows/etc.) and/or LWD piles that prohibit stream access and collection of HGM variables and/or other parameters. *Hand clearing of vegetation is prohibited in the ROW.* Conditions should be documented with the site sketches and photos and excluded from assessment.

5. **Best Professional Judgment**
   a. Not all site and in-stream crossing conditions have been accounted for in the above listings, just the most commonly anticipated.
   b. Best Professional Judgment will need to be made regarding additional conditions that require HGM modifications.

The FCI score determined by the methodology above will be used for comparison to performance standards in future monitoring events.

2.1.5 Visual Assessment Documentation

Photo documentation of existing conditions will be gathered using the guidance and nomenclature as specified in **Table 3** below:

Table 3. Stream Photo Location Requirements

Stream Type	Photographs
Virginia Streams	
Streams (Bankfull width <10’)	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *RB C/L* – Standing on Right Bank looking down pipe centerline (C/L) • *LB C/L* – Standing on Left Bank looking down pipe C/L • *DS COND* – Downstream conditions outside LOD
Streams (Bankfull width >10’)	• *RB DS VIEW* – Downstream View on Right Bank of impact area inside LOD • *LB DS VIEW* – Downstream View on Left Bank of impact area inside LOD • *RB US VIEW* – Upstream View on Right Bank of impact area inside LOD • *LB US VIEW* – Upstream View on Left Bank of impact area inside LOD • *RB C/L* – Standing on Right Bank looking down pipe C/L • *LB C/L* – Standing on Left Bank looking down pipe C/L • *DS COND* – Downstream conditions outside LOD
Streams (Within the LOD but not crossing pipe centerline)	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *DS COND* – Downstream conditions outside LOD
Access Road Crossings	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *C/L ACCESS-1* – Standing in Access Road looking towards impact • *C/L ACCESS-2* – Standing in Access Road looking towards impact • *DS COND* – Downstream conditions outside LOD
West Virginia Streams	
All Streams	• US LOD US VIEW – Upstream Edge of LOD Upstream View • US LOD DS VIEW – Upstream Edge of LOD Downstream View • C LOD US VIEW – Center of LOD Upstream View • C LOD DS VIEW – Center of LOD Downstream View • DS LOD US VIEW – Downstream Edge of LOD Upstream View • DS LOD DS VIEW – Downstream Edge of LOD Downstream View

Stream Type	Photographs
Virginia and West Virginia Streams	
All Streams	• If riffle or pool complexes are present, additional photos will be collected illustrating upstream views (from downstream of riffle or pool) and downstream views (from upstream of riffle or pool).

2.1.6 WV SWVM

Assessment and survey activities will be conducted by utilizing specific methodologies required for completion of the WV SWVM (USACE, 2011), supplemented by other data collection measures documented in this section. Note that in a letter provided by the USACE on May 27, 2021, the USEPA recommended that the WV SWVM forms be used for all aquatic impacts in both states. The WV SWVM incorporates the "Hydrogeomorphic Approach" for developing indices and the protocols used to apply these indices to the assessment of ecosystem performance at a site-specific scale. This approach generates an FCI for hydrology, biogeochemical cycling, and habitat. The worksheet utilizes the USEPA RBP physical habitat forms, the USACE's *Operation Draft Regional Guidebook for the Functional Assessment of High-Gradient Headwater Streams and Low-Gradient Perennial Streams in Appalachia* (USACE, 2017), the WVDEP WVSCI, and water-quality data to interpret the physical, chemical, and biological integrity of "waters of the United States" and generate an index score. Wetland evaluations require data on the wetland acreage and wetland Cowardin type designation. Examples of the WV SWVM forms are included in **Exhibit E**.

The use of the WV SWVM methodology, supplemented by other data noted in this section, is appropriate to maintain a consistent data-collection protocol across the entire project area. Although the WV SWVM methodology is not commonly used in Virginia, it is materially consistent with the methodologies typically employed by the USACE Norfolk District and VADEQ for similar purposes. The VADEQ and USACE Norfolk District employ a methodology (the Unified Stream Methodology (USM)) that is similar to, but less detailed than, the WV SWVM methodology for streams. Wetland impacts and mitigation are calculated on a similar basis (ratios of acreage based on Cowardin Classification).

Table 4 illustrates the data-collection activities that will be conducted based on stream flow regime.

Table 4 - Preliminary Data-Collection Activity Summary per Stream Flow Regime Type

Stream-Flow Regime	Ephemeral	Intermittent	Perennial
Field Water Quality	Stream-Flow Dependent	Stream-Flow Dependent	Stream-Flow Dependent
USM (Virginia Only)	Ephemeral Stream Assessment Form (Form 1a)	Stream Assessment Form (Form 1)	Stream Assessment Form (Form 1)
RBP	Stream-Flow Dependent; Modified Scoring Categories if No Flow	Stream-Flow Dependent; Modified Scoring Categories if No Flow	Stream-Flow Dependent; Modified Scoring Categories if No Flow
Benthic Macroinvertebrates	Stream-Flow Dependent	Stream-Flow Dependent	Stream-Flow Dependent
HGM Assessment	High Gradient	High Gradient	Low Gradient (If Stream Slope is <4%; Wadeable/Shadeable)
Longitudinal Profiles Surveys and Cross Sections[a]	✓	✓	✓

[a]Additional surveys may be required prior to completing the crossings, in the event evaluations determine there have been substantial shifts in streambed morphology. Please refer to Section 2.1.7.

Because there are differences between the West Virginia SWVM and Virginia USM, both are being conducted. **Table 5** summarizes and compares the methodologies utilized in West Virginia and Virginia, as required by the specific states.

Table 5 - West Virginia and Virginia Resource Methodology Requirement Comparison

	West Virginia	Virginia
Stream Resource Valuation Metrics	WV SWVM[1]	USM[2]
Physical Attributes	✓	✓
Water Quality	✓	X
Benthic Macroinvertebrate Sampling	✓	X
HGM Assessment	✓	X
Wetland Resource Valuation Metrics	WV SWVM[1]	Standard Mitigation Ratios
Visual Attributes	✓	✓

[1]West Virginia Stream and Wetland Valuation Methodology
[2]Unified Stream Methodology

2.1.7 Virginia USM (Virginia Streams Only)

For Virginia streams, in addition to completing the WV SWVM form, the USM (USACE and VADEQ, 2007) will be utilized to assign a Reach Conditions Index (RCI) to each proposed temporary stream impact, to assess the type or severity of the temporary impact, to determine the compensation that would be required if the impacts were permanent, and to determine what types of and the amount of the various compensation practices that would satisfy the compensation requirement (if the impacts were permanent). Parameters to be assessed in intermittent and perennial streams are channel condition, riparian buffers, instream habitat/available cover, and channel alteration. Riparian buffer is the only parameter to be assessed in ephemeral streams. Condition indices will be determined utilizing the appropriate USM, forms and the RCI will be calculated for each stream crossing (see **Exhibit F** for examples of USM forms).

3.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Field equipment will be inspected and calibrated at least weekly, prior to field crew deployment per the manufacturers' specifications. A calibration log will be kept for each field water-quality meter utilized. Spare supplies, such as batteries/chargers, calibration fluid, tools, etc., will be carried by each field crew for emergency field repairs of equipment.

A field notebook will be maintained to document conditions encountered while samples are collected, including field observations, photographs taken, samples collected, and deviations from the sampling protocol. Appropriate field forms, as mentioned in previous sections, will be completed as required in the field and copied/filed upon return to the office.

Benthic sample containers and lids will be labeled in the field with sample location/ID, sample type (i.e., kicknet/D-net), field crew initials, date and time of sample, project number, and sample preservative. Chain-of-custody (COC) forms will be generated and maintained with the benthic samples. The COC forms will contain information including project identification, laboratory name, sampler's initials, method of sample shipment/transfer, sample numbers, date and time of sample collection, sample matrix, sample type (grab or composite), preservative used, analysis requested, turn-around time requested, date and time samples were relinquished, and signatures of the persons relinquishing and receiving samples.

Benthic sample sorting, identification, and reporting will be conducted in accordance with the WVDEP WAB SOP (2018). A third-party consultant will be contracted to perform the benthic sample sorting and identification.

Manual data entry in spreadsheets and/or calculations performed will be subjected to a QA/QC review to ensure proper data transfer.

4.0 DATA ANALYSIS AND REPORTING PROCEDURES

The raw data in the form of field data forms, photographs, and laboratory bench sheets for benthic macroinvertebrate identification will be provided to Mountain Valley by the field staff. Data will also be summarized in Excel spreadsheets for comparison and evaluation and for inclusion in a formal report to be provided to USACE, WVDEP, and VADEQ.

5.0 REFERENCES

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EXHIBIT A

EXHIBIT A – FIELD EQUIPMENT LIST

Description

Survey Instruments:

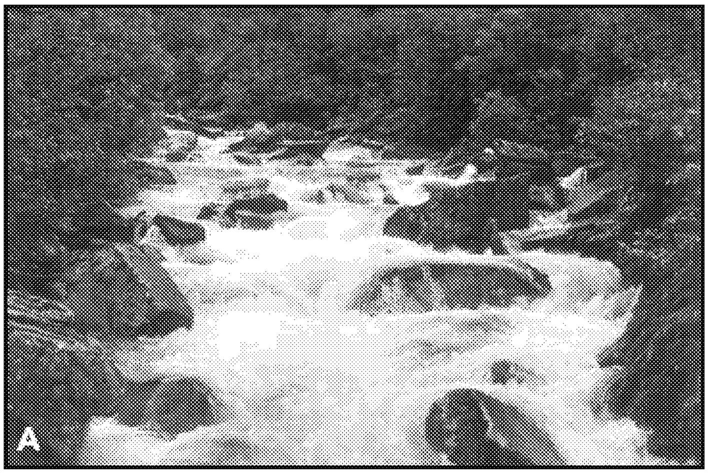
- Laser Level Kit (each includes 2 sensors with brackets or Total Station)
- Survey Rods (25 feet in 10^{ths} and 100^{ths})
- Tripods (aluminum)
- Auto Levels (If Needed)
- Narrow Blade Shovels (4-3/4 x 16)
- Buckets with Bottoms
- Sieve – 600 Micron
- Water Buckets (for wet-sieving)
- Long-Handled Sledge Hammers
- ½ inch x 3 ft. Rebar (for cross-sections)
- Sampling Jars
- Wooden Stakes (3 feet long)

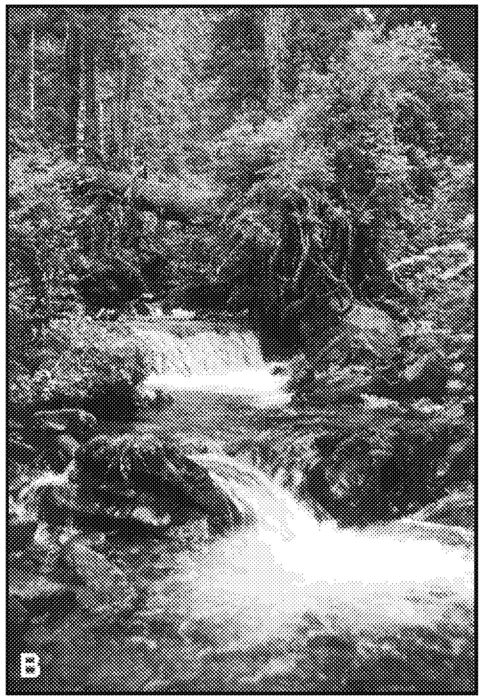
Field Bags:

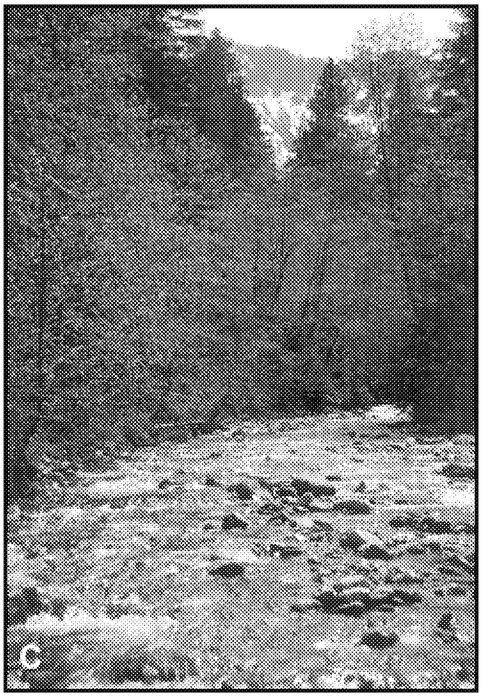
- 300 ft. Measuring Tape (in 10^{ths} & 100^{ths})
- 100 ft. Measuring Tape (in 10^{ths} & 100^{ths})
- Small Sledge Hammer
- Pocket Rod (in ft., 10^{ths} & 100^{ths})
- Rod Level
- Metal Ruler (12 inch)
- Line Level
- Sand Gauge
- Ballpoint Pens (for imprinting metal tags)
- Permanent Markers
- Rolls of Flagging

EXHIBIT B

EXHIBIT B - FIGURES







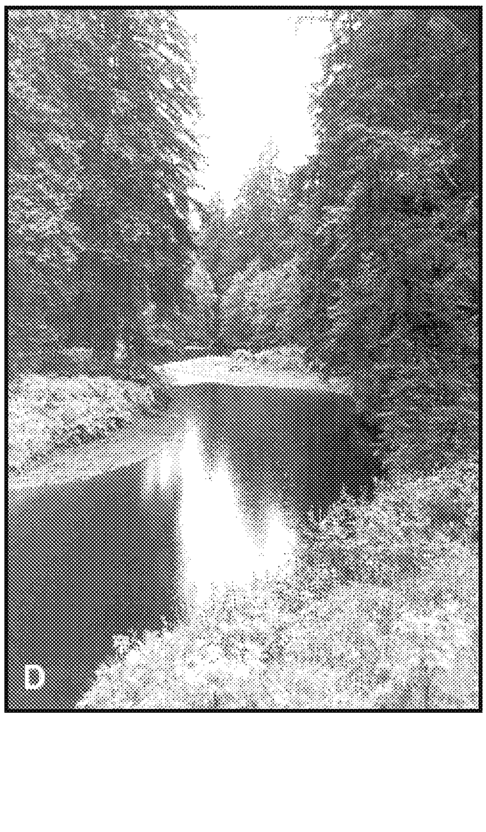
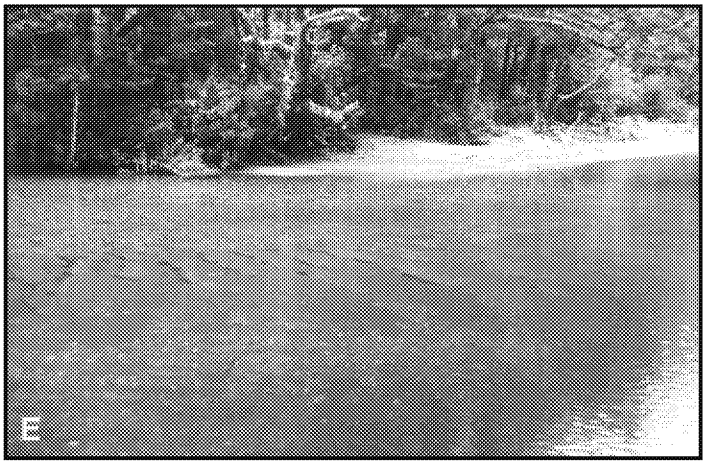
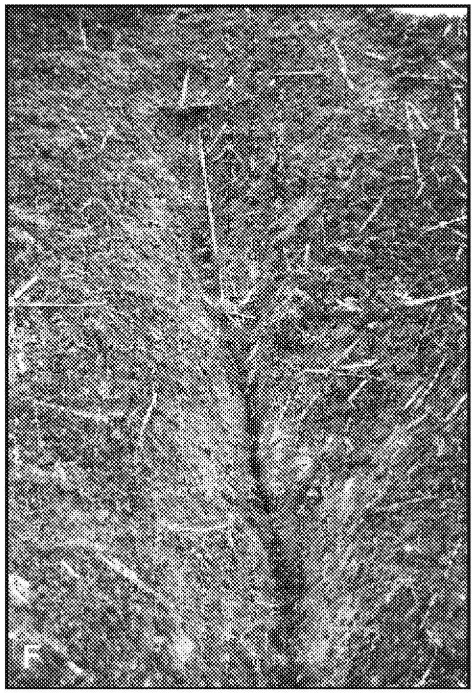


Figure 1. Alluvial channel-reach morphologies: (A) cascade; (B) step pool; (C) plane bed; (D) pool riffle; (E) dune ripple; (F) colluvial (channel in photo is 0.5 m wide); and (G) forced pool riffle.





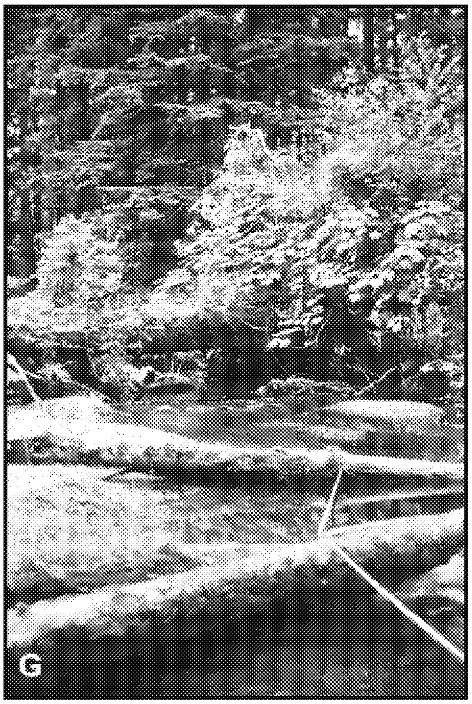


Figure 1. (*Continued—caption on facing page*).

forming material generally is mobile only during relatively infrequent hydrologic events (Whittaker, 1987a, 1987b; Grant et al., 1990), although Warburton (1992) showed that step-forming clasts in steep proglacial channels may be mobile annually. Significant movement of all grain sizes occurs during extreme floods, and step-pool morphology is reestablished during the falling limb of the hydrograph (Sawada et al., 1983; Whittaker, 1987b; Warbuton, 1992). During more frequent discharges, finer material stored in pools travels as bedload over stable bed-forming clasts (Ashida et al., 1981; Whittaker, 1987a, 1987b; Ergenzinger and Schmidt, 1990; Grant et al., 1990; Schmidt and Ergenzinger, 1992). In a series of tracer tests in a step-pool channel, Schmidt and Ergenzinger (1992) found that all of the tagged particles placed in pools mobilized during frequent, moderate discharges and were preferentially redeposited into pools. Transport of all the pool-filling material indicates that sediment transport of non–step-forming grains is supply limited. Bedload studies in step-pool channels demonstrate complex relations between discharge and sediment transport; transport rates are dependent on seasonal and stochastic sediment inputs, flow magnitude and duration, and antecedent events (Nanson, 1974; Griffiths, 1980; Ashida et al., 1981; Sawada et al., 1983; Whittaker, 1987a, 1987b; Warburton, 1992). Ashida et al. (1981), for

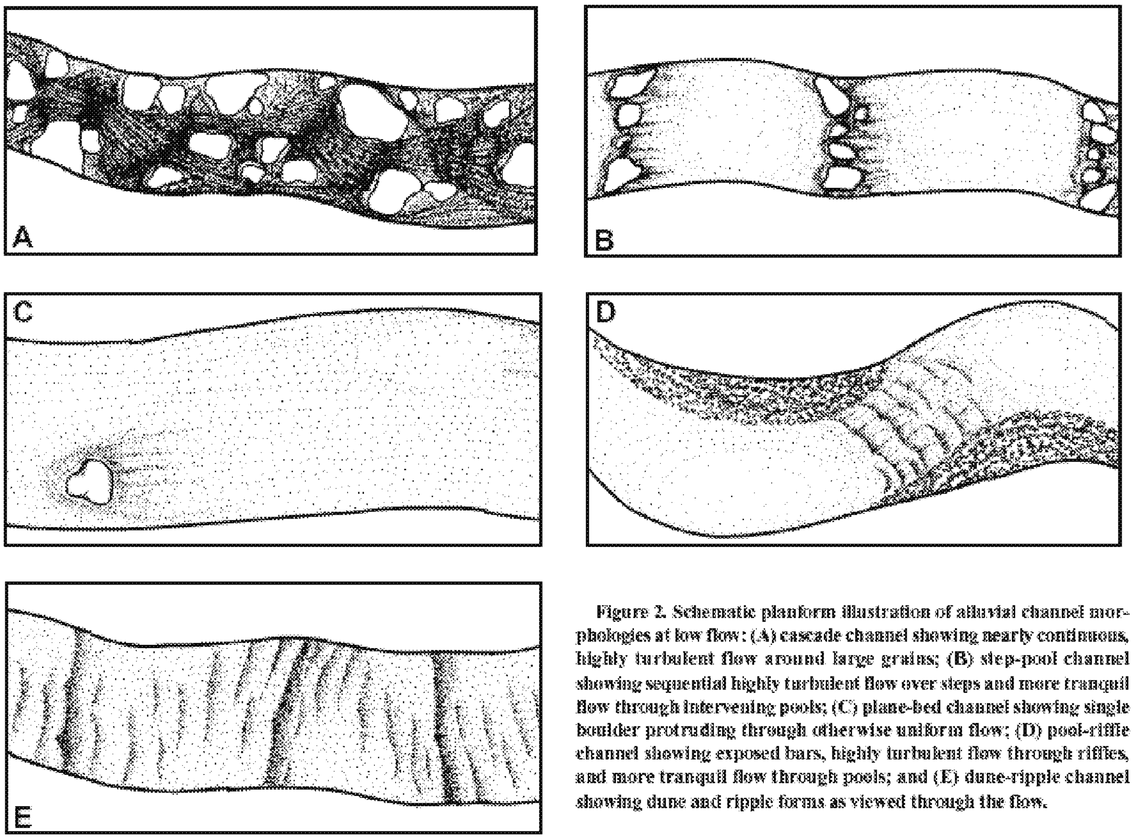


Figure 2. Schematic planform illustration of alluvial channel morphologies at low flow: (A) cascade channel showing nearly continuous, highly turbulent flow around large grains; (B) step-pool channel showing sequential highly turbulent flow over steps and more tranquil flow through intervening pools; (C) plane-bed channel showing single boulder protruding through otherwise uniform flow; (D) pool-riffle channel showing exposed bars, highly turbulent flow through riffles, and more tranquil flow through pools; and (E) dune-ripple channel showing dune and ripple forms as viewed through the flow.

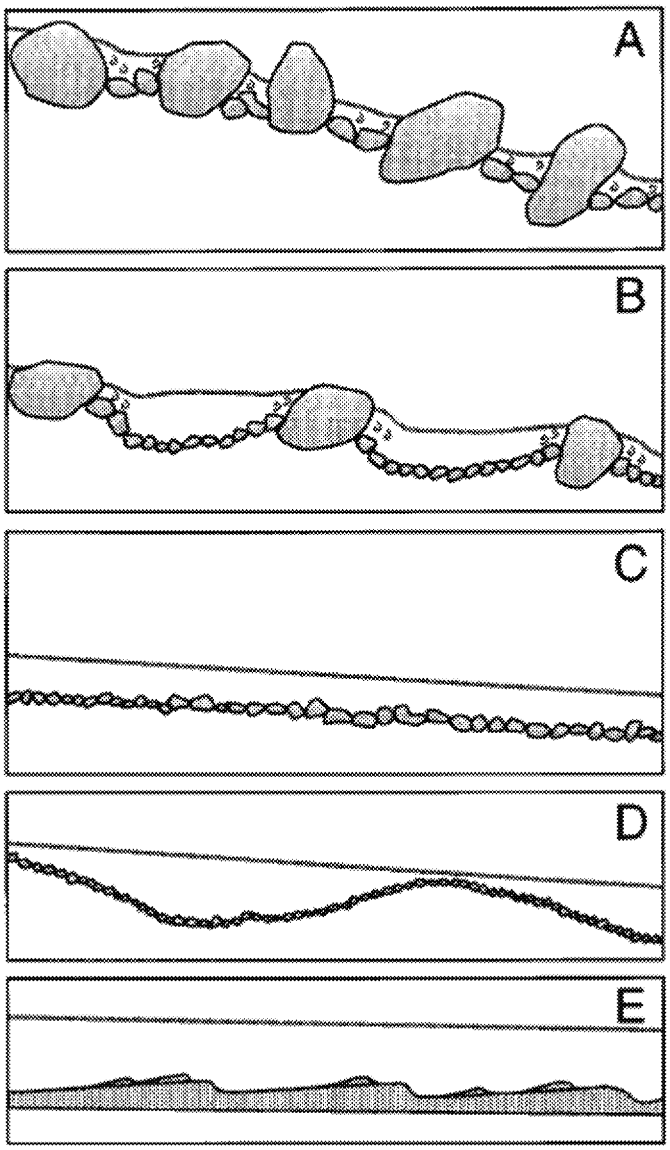


Figure 3. Schematic longitudinal profiles of alluvial channel morphologies at low flow: (A) cascade; (B) step pool; (C) plane bed; (D) pool riffle; and (E) dune ripple.

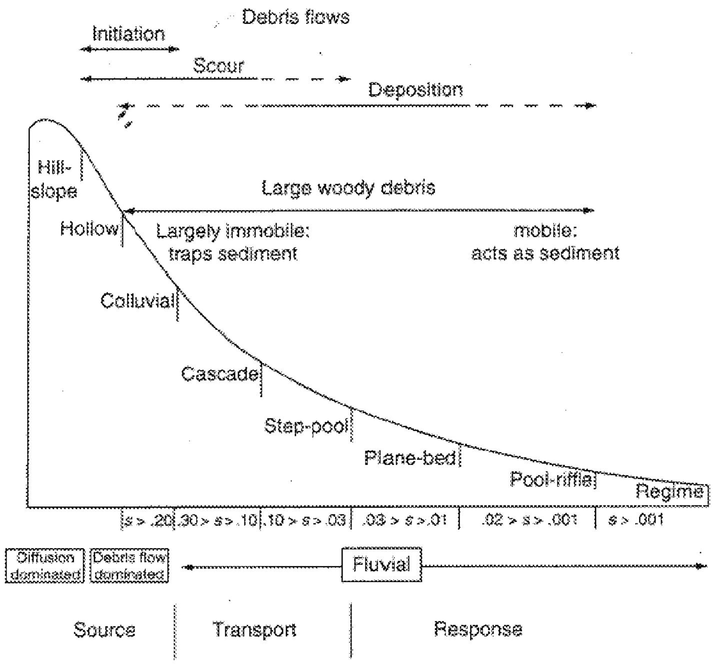


Figure 4 Process domains of Montgomery and Buffington (1997) arranged along a longitudinal gradient (reproduced from Montgomery and Buffington 1997)

EXHIBIT C

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION #________ RIVERMILE________	STREAM CLASS
LAT ______________ LONG ______________	RIVER BASIN
STOREET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE ________ TIME _________ AM PM

REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ❑ storm (heavy rain) ❑ ❑ rain (steady rain) ❑ ❑ showers (intermittent) ❑ ____%❑ %cloud cover ❑____% ❑ clear/sunny ❑ **Has there been a heavy rain in the last 7 days?** ❑ Yes ❑ No **Air Temperature**_____ ^{0} C **Other**________________________________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)**
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ❑ Intermittent ❑ Tidal **Stream Origin** ❑ Glacial ❑ Spring-fed ❑ Non-glacial montane ❑ Mixture of origins ❑ Swamp and bog ❑ Other__________ **Stream Type** ❑ Coldwater ❑ Warmwater **Catchment Area**__________km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other ______________ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** ______________________________
INSTREAM FEATURES	**Estimated Reach Length** _______m **Estimated Stream Width** _______m **Sampling Reach Area** _______m^2 **Area in km^2 (m^2x1000)** _______km^2 **Estimated Stream Depth** _______m **Surface Velocity (at thalweg)** _______m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** _______m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle_______% ❑ Run_______% ❑ Pool_______% **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _______m^2 **Density of LWD** _______m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** ______________________________ **Portion of the reach with aquatic vegetation** _____%
WATER QUALITY	**Temperature**_______ ^{0} C **Specific Conductance**________ **Dissolved Oxygen** ________ **pH** ________ **Turbidity** ________ **WQ Instrument Used** ______________ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other______________ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other______________ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other________
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other______________________ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other______________ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #________ RIVERMILE________	STREAM CLASS	
LAT ______________ LONG ______________	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE ________ TIME ________ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble_____% ❑ Snags_____% ❑ Vegetated Banks_____% ❑ Sand_____% ❑ Submerged Macrophytes_____% ❑ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ❑ D-frame ❑ kick-net ❑ Other ________________________ **How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble_____ ❑ Snags_____ ❑ Vegetated Banks_____ ❑ Sand_____ ❑ Submerged Macrophytes_____ ❑ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION #__________ RIVERMILE__________	STREAM CLASS
LAT ______________ LONG ______________	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE ________ TIME ________ AM PM / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION #_________ RIVERMILE_________	STREAM CLASS
LAT _____________ LONG _____________	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE ________ TIME ________ AM PM — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

EXHIBIT D

Ver. 10-20-17

FCI Calculator for the High-Gradient Headwater Streams in Appalachia

To ensure accurate calculations, the UPPERMOST STRATUM of the plant community is determined based on the calculated value for $V_{CCANOPY}$ (≥20% cover is required for tree/sapling strata). Go to the SAR Data Entry tab and enter site characteristics and data in the yellow cells. For information on determining how to split a project into SARs, see Chapter 5 of the Operational Draft Regional Guidebook for the Functional Assessment of High-Gradient Headwater Streams and Low-Gradient Perennial Streams in Appalachia (Environmental Laboratory U.S. Army Corps of Engineers 2017).

Project Name:
Location:
Sampling Date: Enter dates on Data Form

Choose Site on Data Form | Choose Timing of Data Form

Subclass for this SAR:
Select Stream Type on Data Form

Uppermost stratum present at this SAR:

SAR number:

Functional Results Summary:

Please Fill Out Site and Timing Information on Data Form

Function	Functional Capacity Index
Hydrology	Check Canopy Data
Biogeochemical Cycling	Check Canopy Data
Habitat	Check Canopy Data

Variable Measure and Subindex Summary:

Variable	Name	Average Measure	Subindex
$V_{CCANOPY}$	Percent canpoy over channel.		
V_{EMBED}	Average embeddedness of channel.		
$V_{SUBSTRATE}$	Median stream channel substrate particle size.		
V_{BERO}	Total percent of eroded stream channel bank.		
V_{LWD}	Number of down woody stems per 100 feet of stream.		
V_{TDBH}	Average dbh of trees.		
V_{SNAG}	Number of snags per 100 feet of stream.		
V_{SSD}	Number of saplings and shrubs per 100 feet of stream.		
V_{SRICH}	Riparian vegetation species richness.		
$V_{DETRITUS}$	Average percent cover of leaves, sticks, etc.		
V_{HERB}	Average percent cover of herbaceous vegetation.		
V_{WLUSE}	Weighted Average of Runoff Score for Catchment.		

High-Gradient Headwater Streams in Appalachia
Field Data Sheet and Calculator

Team: ______________________ Latitude/UTM Northing: ____________

Project Name: ______________________ Longitude/UTM Easting: ____________

Location: ______________________ Sampling Date: ____________

SAR Number: Reach Length (ft): ______ Stream Type: Ephemeral/Intermittent (circle one)

Top Strata: (determined from percent calculated in $V_{CCANOPY}$)

Site and Timing: Project/Mitigation Site (circle one) Before/After Project (Circle One)

Sample Variables 1-4 in stream channel

1 $V_{CCANOPY}$ Average percent cover over channel by tree and sapling canopy. Measure at no fewer than 10 roughly equidistant points along the stream. Measure only if tree/sapling cover is at least 20%. (If less than 20%, enter at least one value between 0 and 19 to trigger Top Strata choice.)

List the percent cover measurements at each point below:

2 V_{EMBED} Average embeddedness of the stream channel. Measure at no fewer than 30 roughly equidistant points along the stream. Select a particle from the bed. Before moving it, determine the percentage of the surface and area surrounding the particle that is covered by fine sediment, and enter the rating according to the following table. If the bed is an artificial surface, or composed of fine sediments, use a rating score of 1. If the bed is composed of bedrock, use a rating score of 5.

Embeddedness rating for gravel, cobble and boulder particles (rescaled from Platts, Megahan, and Minshall 1983)

Rating	Rating Description
5	<5 percent of surface covered, surrounded, or buried by fine sediment (or bedrock)
4	5 to 25 percent of surface covered, surrounded, or buried by fine sediment
3	26 to 50 percent of surface covered, surrounded, or buried by fine sediment
2	51 to 75 percent of surface covered, surrounded, or buried by fine sediment
1	>75 percent of surface covered, surrounded, or buried by fine sediment (or artificial surface)

List the ratings at each point below:

3 $V_{SUBSTRATE}$ Median stream channel substrate particle size. Measure at no fewer than 30 roughly equidistant points along the stream; use the same points and particles as used in V_{EMBED}.

Enter particle size in inches to the nearest 0.1 inch at each point below (bedrock should be counted as 99 in, asphalt or concrete as 0.0 in, sand or finer particles as 0.08 in):

4 V_{BERO} Total percent of eroded stream channel bank. Enter the total number of feet of eroded bank on each side and the total percentage will be calculated If both banks are eroded, total erosion for the stream may be up to 200%.

Left Bank: Right Bank:

Sample Variables 5-9 within the entire riparian/buffer zone adjacent to the stream channel (25 feet from each bank).

5 V_{LWD} Number of down woody stems (at least 4 inches in diameter and 36 inches in length) per 100 feet of stream reach. Enter the number from the entire 50'-wide buffer and within the channel, and the amount per 100 feet of stream will be calculated.

Number of downed woody stems:

6 V_{TDBH} Average dbh of trees (measure only if $V_{CCANOPY}$ tree/sapling cover is at least 20%). Trees are at least 4 inches (10 cm) in diameter. Enter tree DBHs in inches.

List the dbh measurements of individual trees (at least 4 in) within the buffer on each side of the stream below:

Left Side					Right Side				

7 V_{SNAG} Number of snags (at least 4" dbh and 36" tall) per 100 feet of stream. Enter number of snags on each side of the stream, and the amount per 100 feet will be calculated.

Left Side: Right Side:

8 V_{SSD} Number of saplings and shrubs (woody stems up to 4 inches dbh) per 100 feet of stream (measure only if tree cover is <20%). Enter number of saplings and shrubs on each side of the stream, and the amount per 100 ft of stream will be calculated.

Left Side: Right Side:

9	V_{SRICH}	Riparian vegetation species richness per 100 feet of stream reach. Check all species present from Group 1 in the tallest stratum. Check all exotic and invasive species present in all strata. Species richness per 100 feet and the subindex will be calculated from these data.	

Group 1 = 1.0		Group 2 (-1.0)	
☐ *Acer rubrum*	☐ *Magnolia tripetala*	☐ *Ailanthus altissima*	☐ *Lonicera japonica*
☐ *Acer saccharum*	☐ *Nyssa sylvatica*	☐ *Albizia julibrissin*	☐ *Lonicera tatarica*
☐ *Aesculus flava*	☐ *Oxydendrum arboreum*	☐ *Alliaria petiolata*	☐ *Lotus corniculatus*
☐ *Asimina triloba*	☐ *Prunus serotina*	☐ *Alternanthera philoxeroides*	☐ *Lythrum salicaria*
☐ *Betula alleghaniensis*	☐ *Quercus alba*		☐ *Microstegium vimineum*
☐ *Betula lenta*	☐ *Quercus coccinea*	☐ *Aster tataricus*	☐ *Paulownia tomentosa*
☐ *Carya alba*	☐ *Quercus imbricaria*	☐ *Cerastium fontanum*	☐ *Polygonum cuspidatum*
☐ *Carya glabra*	☐ *Quercus prinus*	☐ *Coronilla varia*	☐ *Pueraria montana*
☐ *Carya ovalis*	☐ *Quercus rubra*	☐ *Elaeagnus umbellata*	☐ *Rosa multiflora*
☐ *Carya ovata*	☐ *Quercus velutina*	☐ *Lespedeza bicolor*	☐ *Sorghum halepense*
☐ *Cornus florida*	☐ *Sassafras albidum*	☐ *Lespedeza cuneata*	☐ *Verbena brasiliensis*
☐ *Fagus grandifolia*	☐ *Tilia americana*	☐ *Ligustrum obtusifolium*	
☐ *Fraxinus americana*	☐ *Tsuga canadensis*	☐ *Ligustrum sinense*	
☐ *Liriodendron tulipifera*	☐ *Ulmus americana*		
☐ *Magnolia acuminata*			
0 Species in Group 1		0 Species in Group 2	

Sample Variables 10-11 within at least 8 subplots (40" x 40", or 1m x 1m) in the riparian/buffer zone within 25 feet from each bank. The four subplots should be placed roughly equidistantly along each side of the stream.

10 $V_{DETRITUS}$ Average percent cover of leaves, sticks, or other organic material. Woody debris <4" diameter and <36" long are include. Enter the percent cover of the detrital layer at each subplot.

Left Side				Right Side			

11 V_{HERB} Average percentage cover of herbaceous vegetation (measure only if tree cover is <20%). Do *not* include woody stems at least 4" dbh and 36" tall. Because there may be several layers of ground cover vegetation percentages up through 200% are accepted. Enter the percent cover of ground vegetation at each subplot.

Left Side				Right Side			

Sample Variable 12 within the entire catchment of the stream.

12 V_{WLUSE} Weighted Average of Runoff Score for watershed:

Land Use (Choose From Drop List)	Runoff Score	% in Catch-ment	Running Percent (not >100)

Summary			Notes:
Variable	Value	VSI	
$V_{CCANOPY}$			
V_{EMBED}			
$V_{SUBSTRATE}$			
V_{BERO}			
V_{LWD}			
V_{TDBH}			
V_{SNAG}			
V_{SSD}			
V_{SRICH}			
$V_{DETRITUS}$			
V_{HERB}			
V_{WLUSE}			

FCI Calculator for the Low-Gradient Perennial Streams in Appalachia

Go to the SAR Data Entry tab and enter site characteristics and data in the yellow cells or drop down menus. For information on determining how to split a project into SARs, see Chapter 5 of the Operational Draft Regional Guidebook for the Functional Assessment of High-Gradient Headwater Streams and Low-Gradient Perennial Streams in Appalachia (Environmental Laboratory U.S. Army Corps of Engineers 2015).

Project Name:
Location:
Sampling Date: Enter dates on Data Form

Mitigation Site | Before Project

SAR number:

Enter Results in Section C of the Mitigation Sufficiency Calculator

Functional Results Summary:

Function	Functional Capacity Index
Hydrology	
Biogeochemical Cycling	
Habitat	

Variable Measure and Subindex Summary:

Variable	Name	Average Measure	Subindex
$V_{CCANOPY}$	Percent canopy over channel.		
V_{EMBED}	Average embeddedness of channel.		
$V_{SUBSTRATE}$	Median stream channel substrate particle size.		
$V_{BANKSTAB}$	Weighted lengths of erosion by class		
V_{LWD}	Number of down woody stems per 100 feet of stream.		
V_{TDBH}	Average dbh of trees.		
V_{TDEN}	Average Density of Trees		
V_{CVALUE}	Average Coefficient of Conservatism of riparian species.		
V_{FOREST}	Percent forest cover for Catchment.		

Low-Gradient Perennial Streams in Appalachia
Field Data Sheet and Calculator

Assessment Team: ______________________ Latitude/UTM Northing: ____________

Project Name: ______________________ Longitude/UTM Easting: ____________

Location: ______________________ Sampling Date: ____________

SAR Number: Thalweg Length (ft): ________ (300 ft suggested minimum)

Site and Timing: Mitigation Site ▼ Before Project ▼

Sample Variables 1-4 in stream channel

1 $V_{CCANOPY}$ Average percent cover over channel by tree and sapling canopy. Measure at no fewer than 10 roughly equidistant points along the stream. Measure for all streams, even if cover is less than 20%.

List the percent cover measurements at each point below (between 0 and 100):

2 V_{EMBED} Average embeddedness of the stream channel. Measure at no fewer than 60 roughly equidistant points along the stream. Select a particle from the bed. Before moving it, determine the percentage of the surface and area surrounding the particle that is covered by fine sediment, and enter the rating according to the following table. If the bed is an artificial surface, or composed of fine sediments, use a rating score of 1. If the bed is composed of bedrock, use a rating score of 5.

Embeddedness rating for gravel, cobble and boulder particles (rescaled from Platts, Megahan, and Minshall 1983)

Rating	Rating Description
5	<5 percent of surface covered, surrounded, or buried by fine sediment **(or bedrock)**
4	5 to 25 percent of surface covered, surrounded, or buried by fine sediment
3	26 to 50 percent of surface covered, surrounded, or buried by fine sediment
2	51 to 75 percent of surface covered, surrounded, or buried by fine sediment
1	>75 percent of surface covered, surrounded, or buried by fine sediment **(or artificial surface)**

List the ratings at each point below:

3 $V_{SUBSTRATE}$ Median stream channel substrate particle size. Measure at no fewer than 60 roughly equidistant points along the stream; use the same points and particles as used in V_{EMBED}.

Enter particle size in inches to the nearest 0.1 inch at each point below (bedrock should be counted as 99 in, asphalt or concrete as 0.0 in, sand or finer particles as 0.08 in):

4 $V_{BANKSTAB}$ This variable is an index incorporating three elements of bank stability: 1) bank erosion length, 2) height category of eroded bank (0.1–2 ft, 2.1–4 ft, >4 ft, or artificial stabilization), and 3) length of artificial stream bank stabilization. Measure the length of the SAR along the thalweg, and enter at the top of the page. Record the length of each eroded area, using the drop down menus to select erosion class. Measure erosion on both sides of the stream. Index ranges from 0 to 200.

☐ Check here if there is no erosion on either bank.

Length of SAR at thalweg (ft):

Total Weighted Erosion length (ft):

Left Stream Bank				**Right Stream Bank**			
Height of Erosion Category	Height Index	Length	Contri-bution	Height of Erosion Category	Height Index	Length	Contri-bution
Left Bank Erosion length:		0 ft		Right Bank Erosion length:		0 ft	

Sample Variable 5 within the entire riparian/buffer zone adjacent to the stream channel (50 feet from each bank).

5 V_{LWD} Number of down woody stems (at least 4 inches in diameter and 36 inches in length) per 100 feet of stream reach. Enter the number from the entire buffer: 50' from each bank and within the channel. The amount per 100 feet of stream will be calculated based on the stream reach length entered at the top of the page.

Number of downed woody stems:

Sample Variable 6-8 within at least four 0.032-acre (21' radius) plots within the riparian/buffer zone adjacent to the stream channel (50 feet from each bank).

6 V_{TDBH} Average dbh of trees. Trees are at least 4 inches (10 cm) in diameter. Enter tree DBHs in inches.

Use at least 4 plots. List the dbh measurements of individual trees (at least 4 in) within 4-6 plots placed in the buffer on each side of the stream:

Plot 1		**Plot 2**		**Plot 3**		**Plot 4**		**Plot 5**		**Plot 6**	
☐ Plot Used ☐ No Trees		☐ Plot Used ☐ No Trees		☐ Plot Used ☐ No Trees		☐ Plot Used ☐ No Trees		☐ Plot Used ☐ No Trees		☐ Plot Used ☐ No Trees	
Plot Average		Plot Average		Plot Average		Plot Average		Plot Average		Plot Average	

7	V_{TDEN}	Tree density, based on trees recorded for V_{TDBH} in four to six 0.032-acre plots. At least four plots must be used.	
8	V_{CVALUE}	Coefficient of conservatism. The average published Coefficients of Conservatism for all native trees and all non-natives in any strata. Coefficients of Conservatism range from 0 (non-natives) to 10 (natives with high fidelity to a specific habitat). Use Drop down menus to select species, once per species. Non-natives are recorded if they occur anywhere in the riparian/buffer zone	

Native Trees				**Non-Natives in Any Strata**			
Species	C-Value	Species	C-Value	Species	C-Value	Species	C-Value

Sample Variable 9 within the entire catchment of the SAR.

9	V_{FOREST}	Percent cover of forested area within the entire watershed that provides water to the perennial stream. Using GIS or aerial photos, enter the estimated percent cover of forest directly, or the acreage of the entire watershed and then the acreage of forested area, below (direct measure will take precedence if both are entered) .	

Estimated percent cover of forest in the catchment of the SAR:

OR

Estimated acreage for the catchment of the SAR:

Estimated acreage of forest in the catchment of the SAR:

Summary			Notes:
Variable	Value	VSI	
$V_{CCANOPY}$			
V_{EMBED}			
$V_{SUBSTRATE}$			
$V_{BANKSTAB}$			
V_{LWD}			
V_{TDBH}			
V_{TDEN}			
V_{CVALUE}			
V_{FOREST}			

Add Notes and a Site Sketch in this space:

EXHIBIT E

West Virginia Stream and Wetland Valuation Metric v2.1

(September 2017)

The SWVM is composed of six tabs including the following: Instructions, Stream Parts I-II, Stream Parts III-VI, Multiple Site Unit Comparison, Wetland Parts I-III and Wetland Parts IV-V. The SWVM has been designed to indicate where data entry is required. All cells or fields highlighted in red shall be populated by the applicant, consultant or practitioner. Below are descriptions of the information or data being requested:

Stream Valuation Metric:

Stream Parts I-II

Cell B1 [USACE File No./Project Name] -Enter USACE File Number as well as the overall project name. Mining-related projects should also include the SMCRA Permit No in this field.

Cell L1 [Impact Site Lat.] – Enter latitude coordinate in NAD 83 Decimal Degrees

Cell N1 [Impact Site Long.] – Enter longitude coordinate in NAD 83 Decimal Degrees

Cell R1 [Weather] – Enter the weather conditions on the date the assessment was performed. Ex. Cloudy, 40 degrees.

Cell X1 [Date] – Enter date of the assessment being performed

Cell B2 [Stream Classification] – Enter the classification of stream being assessed. Choices are provided from the drop-down list (i.e. ephemeral, intermittent or perennial)

Cell L2 [Impact Stream/Site ID and Site Description] – Enter the stream name, stream segment identifier (which may correlate to a drawing), % streambed slope, watershed acreage and riparian condition (i.e. mature tree stratum)

Cell W2 [Mitigation Stream Class/ Site ID Description] - Enter stream classification for stream that mitigation will be performed on and stream segment identifier (which may correlate to a drawing), % streambed slope, watershed acreage and riparian condition (i.e. mature tree stratum)

Cell B3 [Stream Impact Length] – Enter the length of the impact (in linear feet)

*Note: when using this metric to only assess mitigation (i.e. preservation) no impact length should be entered and no data is necessary in Column No. 1-Impact Existing Condition (Debit)

Cell F3 [Form of Mitigation] – Enter the form of mitigation. Choices are provided from the drop-down list

Cell L3 [Mitigation Site Lat.] – Enter the mitigation site latitude coordinate in NAD 83 Decimal Degrees

Cell N3 [Mitigation Site Long.] – Enter the mitigation longitude coordinate in NAD 83 Decimal Degrees

Cell R3 [Precipitation Past 48 Hrs] – Enter the past 48 hrs precipitation for the impact site being assessed

Cell X3 [Mitigation Length] – Enter the linear feet of the compensatory mitigation proposed

COLUMN No. 1 – Impact Existing Condition (Debit) – This column establishes the baseline conditions of the proposed impact site. All projects proposing an impact (debit) to waters of the U.S. shall enter data in this column, as follows:

Part I – Physical, Chemical and Biological Indicators

Cells B9 – B11 [HGM] – Input Hydrology, Biogeochemical Cycling and Habitat Functional Capacity Index (FCI) scores generated by completing the HGM assessment, when applicable. HGM data forms should accompany the submittal of SWVM assessments. An average is taken between the three HGM FCI scores. This is then averaged with the overall SWVM score to indicate a final index score.

Cell B5 - Select Impact Stream Classification

Cell D7 - Input Percent Stream Channel Slope for Impact Stream

Cells D15 – D25 [Physical Indicator] - Indicate the physical condition of the stream by applying the USEPA RBP. The Physical descriptor for streams relies upon the data collected for the USEPA RBP Stream Data Sheet. This part of the metric allows the user to choose the High Gradient or Low Gradient Stream Data Sheet, as applicable. This portion of the Part I is required for all stream classifications. When completing impact and mitigation site assessments on high-gradient Ephemeral streams, practitioners should insert "0"s in fields 1, 3, 5 and 7 of the USEPA RBPs.

Cells D31, D34 and D37 [Chemical Indicator] - Indicate the chemical condition or water quality of the stream by inputting the data, which is based upon key parameters historically utilized by the WVDEP. This portion of Part I shall be completed for wadeable perennial, intermittent and ephemeral stream classifications (where applicable). Ephemeral stream water quality data shall be obtained during (or a short period after) a precipitation event within the reach being assessed or immediately downstream. When the immediate downstream method is necessary this shall be noted in Cell L2 or at the bottom of the assessment sheet. In the event data for these fields are not provided, good water quality will be assumed.

Cell D42 [Biological Indicator] - Indicate the biological condition of the stream by inputting the data based upon the West Virginia Stream Condition Index (WVSCI) of the WVDEP Save Our Stream Protocol. It is recommended this portion of Part I be completed for perennial and intermittent stream classifications. In the event this data cannot be obtained (i.e. ephemeral stream), the metric will generate an index score based upon the Physical and Chemical Indicators.

COLUMN No. 2 – Mitigation Existing Condition (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 2. This column is utilized to establish the baseline conditions for the mitigation site. In cases where an impact and mitigation will occur at the exact same site (i.e. sediment pond construction and restoration), this column should reflect baseline mitigation conditions as "0"[1].

Cell G5 - Select Mitigation Stream Classification

Cell I7 - Input Percent Stream Channel Slope for Mitigation Stream

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 3 – Mitigation Projected at Five Years Post Completion (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 3. This column is utilized to establish the projected condition of the site after five years of completion. Generally, there should not be a dramatic or substantial increase in functional unit scores between year 5 and 10 projected assessments (i.e. the duration of total stream buffer revegetation will typically be the last element to reach maturity for optimal functional input). The five year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions (when it is determined five years of monitoring is appropriate by USACE).

For example purposes, a sediment pond restoration site (mitigation site) which formerly required total elimination of the riparian vegetative buffer and received a full re-vegetation application of native tree, shrub and grass stratum species would be expected to score within the following USEPA RBP individual parameter ranges (High Gradient Data Sheet) after five years of restoration.

USEPA RBP									
Epifaunal Substrate	Embeddedness	Velocity Depth Regime	Sediment Deposition	Channel Flow Status	Channel Alteration	Frequency of Riffles	Bank Stability (LB&RB)	Vetetative Protection (LB&RB)	Riparian Vegetative Zone (LB&RB)
8-12	8-12	6-10	8-13	0-20	11-15	11-18	12-16	8-12	0-20

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 4 – Mitigation Projected at Ten Years Post Completion (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 4. This column is utilized to establish the projected condition of the site after ten years of completion. The ten year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions. The ten year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions (when it is determined ten years of monitoring is appropriate by USACE).

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 5– Mitigation Projected Upon Maturity (Credit)
All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 5. This column is utilized to establish the projected condition of the site at maturity. The full restoration of a riparian buffer zone may require 40 or more years of sustained growth to contribute detritus and large woody debris, and provide light and temperature regulation.

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

PART II – Index and Unit Score - No data entry is required in Part II, the Index Score is multiplied by the linear feet of impact (debit) to generate a raw Unit Score.

Stream Parts III-VI

Part III- Impact Factors
Cell C8 [Temporal Loss-Construction] - Enter the number of years reflecting the duration of aquatic functional loss between the time of impact (debit) and completion of compensatory mitigation (credit). For example, if Permittee-Responsible On-site mitigation is proposed and it will be five (5) years before the mitigation will be completed then enter a "5".

DEFAULT VALUES: The default value for ILF is 4 years and Mitigation Banking (provided Mitigation Bank credits have been approved and are available) is 0 years.

Cell C19 [Temporal Loss-Maturity] - Enter the number of years representing the period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. the full restoration of a riparian buffer zone may require 40 or more years of sustained growth to contribute detritus and large woody debris and provide light and temperature regulation).

Cell H7 [Long-term Protection] - Enter the number of years representing the period of protection proposed for the mitigation site. Long-term protection is obtained via conservation easements or deed restrictions to ensure sustainable gains in values. Perpetual protection should be entered as "101" or "Perpetual".

DEFAULT VALUES: The default value for Mitigation Banking and/or ILF is "Perpetual" since these projects are required by the IRT to obtain perpetual protection.
Part IV- Comparison of Unit Scores and Projected Balance - No data entry is required. This part depicts the "Final Unit Score (debit)" in comparison with the Mitigation Existing Condition (credit), Mitigation Projected Upon Completion (credit) and the Mitigation Projected at Maturity (credit). The balance of the "Mitigation Projected at Maturity" shall be equal to or greater than the "Final Unit Score (debit)" to adequately offset the proposed impacts and be compliant with the national policy of "no net loss".

Part IV- Index to Unit Score Conversion - No data entry is required. This section displays the final index score, which is utilized to generate a final debit unit score. For your convenience, this section also indicates the ILF amount that would be required to offset the final debit units.

*Note: All forms of compensatory mitigation now focus upon offsetting the final (debit) units rather than the linear feet except where the SWVM is not applicable (i.e. non-wadeable stream impacts).

Part V – Comparison of Unit Scores and Projected Balance - No data entry is required. This part depicts the "Final Unit Score (debit)" in comparison with the Mitigation Existing Condition-Baseline (credit), Mitigation Projected at Five Years (credit), Mitigation Projected at Ten Years (credit), and Mitigation Projected at Maturity (credit). Functional lift is defined as the balance between the "Mitigation Existing Condition-Baseline" and "Mitigation Projected at Maturity". The balance of the "Mitigation Projected at Maturity" shall be equal to or greater than the "Final Unit Score (debit)" to adequately offset the proposed impacts and be compliant with the national policy of "no net loss".

*Note: The yellow highlighted cells (Cells A43, C43 and D43) may be cut and copied to the next tab "Multiple Site Unit Comparison" for compiling data on multiple streams or stream segments. For submittal purposes, the Multiple Site Unit Comparison should be accompanied by individual Stream Valuation Metric spreadsheets for each stream or stream segment.

Part VI - Mitigation Considerations
Extent of Stream Restoration
Cells D32-D34 – Reference the IRT defined levels of Restoration and place an "x" in the appropriate Stream Restoration Level.

Extended Upland Buffer Zone
Cells F34-F37 – Insert the width of the buffer zone up to 150 feet from each stream channel side.

Cells H34-H35 and H37-H38 – Select from pull down box the class of buffer preservation and/or revegetation being performed.

Multiple Site Unit Comparison
When assessing multiple reaches or streams Cell Nos. A43-C43 should be copied and pasted into this table, which keeps a running tally of the debits and credits. When pasting choose "Paste Special" and then select "values and number format".

Wetland Valuation Metric:

Wetland Parts I-III

Cell B1 [USACE File No./Project Name] -Enter USACE File Number as well as the overall project name. Mining-related projects should also include the SMCRA Permit No in this field.

Cell L1 [Lat.] – Enter latitude coordinate in NAD 83 Decimal Degrees

Cell N1 [Long.] – Enter longitude coordinate in NAD 83 Decimal Degrees

Cell G2 [Stream/Site ID and Site Description] – Enter the wetland name, wetland identifier (which may correlate to a drawing), watershed acreage and riparian condition (i.e. mature tree stratum)

Cell B3 [Wetland Impact Acreage] – Enter the acreage of the impact

Cell F3 [Form of Mitigation] – Enter the form of mitigation. Choices are provided from the drop-down list

Cell M3 [Mitigation Acreage] – Enter the acreage of the compensatory mitigation proposed

Cell B4 [Date] – Enter date of the assessment being performed

Cell G3 [Weather Conditions] – Enter the weather conditions from the site during the assessment

Cell M4 [Precipitation Past 48 Hrs] – Enter the past 48 hrs precipitation for the site being assessed

Part I- Wetland Indicators
Cells A7 – A18 [Wetland ID] - Enter the wetland identification for each wetland impact (which may correspond to a drawing)

Cells B7 – B18 [Existing Classification] – Enter the wetland classification being assessed. Choices are provided from the drop-down list.

Cells D7 – D18 [Impacts] – Enter the amount of impacts (in acres) for each wetland.

Cells F7 –F18 [Mitigation Classification] – Enter the wetland classification being mitigated. Choices are provided from the drop-down list.
Part II- Unit Scores - No data entry is required. This part indicates the total Unit Scores or Replacement Units for each individual classification of wetlands.

Part III- Advanced Mitigation - Enter a "Yes" or "No" to indicate compensatory mitigation has been completed and determined sustainable in advance of any proposed impacts.

DEFAULT VALUES: Approved forms of advanced mitigation determined to be sustainable may be provided to offset impacts on a 1:1 ratio, within the same wetland classification.

Estimated In-Lieu Fee Costs – A comparison of the In-Lieu Fee costs associated with the proposed impacts is provided for reference purposes.

Wetland Parts IV-V

Part IV- Factors
Cell C6 [Temporal Loss-Construction] - Enter the number of years reflecting the duration of aquatic functional loss between the time of impact (debit) and completion of compensatory mitigation (credit). For example, if Permittee-Responsible On-site mitigation is proposed and it will be five (5) years before the mitigation will be completed then enter a "5".

DEFAULT VALUES: The default value for ILF is 4 years and Mitigation Banking (providing Mitigation Bank credits have been approved and are available) is 0 years.

Cell C17 [Temporal Loss-Maturity] - Enter the number of years representing the period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function.

Cell H5 [Long-term Protection] - Enter the number of years representing the period of protection proposed for the mitigation site. Long-term protection is obtained via conservation easements or deed restrictions to ensure sustainable gains in values. Perpetual protection should be entered as "101" or "Perpetual".

DEFAULT VALUES: The default value for Mitigation Banking and/or ILF is "Perpetual" since these projects are required to obtain perpetual protection.

Extended Upland Buffer Zone
Cells F16 – Insert the average width of the buffer zone up to 150 feet from wetland boundary.

Cells H16-H17 – Select from pull down box the class of buffer preservation and/or revegetation being performed.

Part V- Final Unit Score - This part is utilized as a reference for obtaining the Replacement Index (debit), Final Unit Score to Offset (credit) and the balance. The Final Unit Score has been adjusted to compensate for the factors input in Part IV and is the final figure necessary to be entirely offset by mitigation (credit).

Cell D25 [Form of Mitigation] – Enter the form of mitigation from the drop-down list.

Cells H25 – H28 [Applicant Input Mitigation (acres)] - Enter the acreage for each classification of wetland mitigation being proposed. The balance should be equal to or greater than the "Final Unit Score to Offset (credit)" to provide an adequate level of compensatory mitigation for offsetting the proposed impacts and be compliant with the national policy of "no net loss".

West Virginia Stream and Wetland Valuation Metric (SWVM)
Version 2.1, September 2017

USACE FILE NO./ Project Name: (v2.1, Sept 2015)		IMPACT COORDINATES: (in Decimal Degrees)	Lat.		Lon.		WEATHER:	Sunny	DATE:	9/15/2015
IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (watershed size {acreage}, unaltered or impairments)			MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (watershed size {acreage}, unaltered or impairments)						Comments:	
STREAM IMPACT LENGTH:		FORM OF MITIGATION:	RESTORATION (Levels I-III)	MIT COORDINATES: (in Decimal Degrees)	Lat.		Lon.		PRECIPITATION PAST 48 HRS:		Mitigation Length:	

Column No. 1- Impact Existing Condition (Debit)

Stream Classification:			
Percent Stream Channel Slope			3
HGM Score (attach data forms):			
			Average
Hydrology	0.5		0.5
Biogeochemical Cycling	0.5		
Habitat	0.5		
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
100-199 - 85 points	0-90	0-1	
pH			
5.6-5.9 = 45 points	0-80		
DO			
	10-30		
Sub-Total			
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
0	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.450	0	0

Column No. 2- Mitigation Existing Condition - Baseline (Credit)

Stream Classification:			
Percent Stream Channel Slope			
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (Low Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Pool Substrate Characterization	0-20		
3. Pool Variability	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Channel Sinuosity	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)

Stream Classification:			B
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)

Stream Classification:			B
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 5- Mitigation Projected at Maturity (Credit)

Stream Classification:			B
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	18
2. Embeddedness	0-20		18
3. Velocity/ Depth Regime	0-20		18
4. Sediment Deposition	0-20		17
5. Channel Flow Status	0-20		19
6. Channel Alteration	0-20		18
7. Frequency of Riffles (or bends)	0-20		18
8. Bank Stability (LB & RB)	0-20		18
9. Vegetative Protection (LB & RB)	0-20		18
10. Riparian Vegetative Zone Width (LB & RB)	0-20		18
Total RBP Score	Optimal		180
Sub-Total			0.9
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
100-199 - 85 points	0-90	0-1	170.2
pH			
6.0-8.0 = 80 points	5-90		7.01
DO			
>5.0 = 30 points	10-30		5.68
Sub-Total			0.975
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Very Good	0-100	0-1	85
Sub-Total			0.85

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.908333333	0	0

PART III - Impact Factors
(See instruction page to insert default values for MITIGATION BANKING and ILF)

Temporal Loss-Construction

Note: Reflects duration of aquatic functional loss between the time of an impact (debit) and completion of compensatory mitigation (credit).

Years	
Sub-Total	0

Temporal Loss-Maturity

Note: Period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. maturity of tree stratum to provide organic matter and detritus within riparian stream or wetland buffer corridor).

% Add. Mitigation	Temporal Loss-Maturity (Years)
0%	
Sub-Total	0

Long-term Protection

% Add. Mitigation and Monitoring Period	Long-Term Protection (Years)
50% + 20 Year Monitoring	
Sub-Total	0.225

PART IV - Index to Unit Score Conversion

Final Index Score (Debit)	Linear Feet	Unit Score (Debit)	ILF Costs (Offsetting Debit Units)
0.675	0	0	$0.00

PART V- Comparison of Unit Scores and Projected Balance

Final Unit Score (Debit) [No Net Loss Value]	0	Mitigation Existing Condition - Baseline (Credit)		Mitigation Projected at Five Years Post Completion (Credit)		Mitigation Projected at Ten Years Post Completion (Credit)		Mitigation Projected At Maturity (Credit)	
FINAL PROJECTED NET BALANCE					0		0		0

Part VI - Mitigation Considerations (Incentives)

Extent of Stream Restoration

*Note1: Reference the Instructional handout to determine the correct Restoration Levels (below) for your project
*Note2: Place an "X" in the appropriate category (only select one).

Restoration Level 1	
Restoration Level 2	
Restoration Level 3	

Compensatory Mitigation Plan incorporates HUC 12-based watershed approach? (Yes or No) *Note: HUC 12-based watershed approach required to obtain Stream Restoration incentive	Y

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)
	0	#DIV/0!

Extended Upland Buffer Zone

*Note[1]: Reference Instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below)
*Note[2]: Enter the buffer width for each channel side (Left Bank and Right Bank)
*Note[3]: Select the appropriate mitigation type

Buffer Width	Left Bank	
	0-50	Preservation and Re-vegetation
	51-150	Preservation and Re-vegetation
Buffer Width	**Right Bank**	
	0-50	Preservation and Re-vegetation
	51-150	Preservation and Re-vegetation
Average Buffer Width/Side	0	

	Straight Preservation Ratio (v2.1, Sept 2015)
Final Mitigation Unit Yield	
#DIV/0!	

ED_006496_00000033-00068

Multiple Stream Site Unit Comparison

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)	Sub-Totals	Running Balance (Debit or Credit)
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
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			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
Sub-Totals	**0**	**0**		0
TOTAL NET				

West Virginia Stream and Wetland Valuation Metric v2.1

(September 2017)

The SWVM is composed of six tabs including the following: Instructions, Stream Parts I-II, Stream Parts III-VI, Multiple Site Unit Comparison, Wetland Parts I-III and Wetland Parts IV-V. The SWVM has been designed to indicate where data entry is required. All cells or fields highlighted in red shall be populated by the applicant, consultant or practitioner. Below are descriptions of the information or data being requested:

Stream Valuation Metric:

Stream Parts I-II

Cell B1 [USACE File No./Project Name] -Enter USACE File Number as well as the overall project name. Mining-related projects should also include the SMCRA Permit No in this field.

Cell L1 [Impact Site Lat.] – Enter latitude coordinate in NAD 83 Decimal Degrees

Cell N1 [Impact Site Long.] – Enter longitude coordinate in NAD 83 Decimal Degrees

Cell R1 [Weather] – Enter the weather conditions on the date the assessment was performed. Ex. Cloudy, 40 degrees.

Cell X1 [Date] – Enter date of the assessment being performed

Cell B2 [Stream Classification] – Enter the classification of stream being assessed. Choices are provided from the drop-down list (i.e. ephemeral, intermittent or perennial)

Cell L2 [Impact Stream/Site ID and Site Description] – Enter the stream name, stream segment identifier (which may correlate to a drawing), % streambed slope, watershed acreage and riparian condition (i.e. mature tree stratum)

Cell W2 [Mitigation Stream Class/ Site ID Description] - Enter stream classification for stream that mitigation will be performed on and stream segment identifier (which may correlate to a drawing), % streambed slope, watershed acreage and riparian condition (i.e. mature tree stratum)

Cell B3 [Stream Impact Length] – Enter the length of the impact (in linear feet)

*Note: when using this metric to only assess mitigation (i.e. preservation) no impact length should be entered and no data is necessary in Column No. 1-Impact Existing Condition (Debit)

Cell F3 [Form of Mitigation] – Enter the form of mitigation. Choices are provided from the drop-down list

Cell L3 [Mitigation Site Lat.] – Enter the mitigation site latitude coordinate in NAD 83 Decimal Degrees

Cell N3 [Mitigation Site Long.] – Enter the mitigation longitude coordinate in NAD 83 Decimal Degrees

Cell R3 [Precipitation Past 48 Hrs] – Enter the past 48 hrs precipitation for the impact site being assessed

Cell X3 [Mitigation Length] – Enter the linear feet of the compensatory mitigation proposed

COLUMN No. 1 – Impact Existing Condition (Debit) – This column establishes the baseline conditions of the proposed impact site. All projects proposing an impact (debit) to waters of the U.S. shall enter data in this column, as follows:

Part I – Physical, Chemical and Biological Indicators

Cells B9 – B11 [HGM] – Input Hydrology, Biogeochemical Cycling and Habitat Functional Capacity Index (FCI) scores generated by completing the HGM assessment, when applicable. HGM data forms should accompany the submittal of SWVM assessments. An average is taken between the three HGM FCI scores. This is then averaged with the overall SWVM score to indicate a final index score.

Cell B5 - Select Impact Stream Classification

Cell D7 - Input Percent Stream Channel Slope for Impact Stream

Cells D15 – D25 [Physical Indicator] - Indicate the physical condition of the stream by applying the USEPA RBP. The Physical descriptor for streams relies upon the data collected for the USEPA RBP Stream Data Sheet. This part of the metric allows the user to choose the High Gradient or Low Gradient Stream Data Sheet, as applicable. This portion of the Part I is required for all stream classifications. When completing impact and mitigation site assessments on high-gradient Ephemeral streams, practitioners should insert "0"s in fields 1, 3, 5 and 7 of the USEPA RBPs.

Cells D31, D34 and D37 [Chemical Indicator] - Indicate the chemical condition or water quality of the stream by inputting the data, which is based upon key parameters historically utilized by the WVDEP. This portion of Part I shall be completed for wadeable perennial, intermittent and ephemeral stream classifications (where applicable). Ephemeral stream water quality data shall be obtained during (or a short period after) a precipitation event within the reach being assessed or immediately downstream. When the immediate downstream method is necessary this shall be noted in Cell L2 or at the bottom of the assessment sheet. In the event data for these fields are not provided, good water quality will be assumed.

Cell D42 [Biological Indicator] - Indicate the biological condition of the stream by inputting the data based upon the West Virginia Stream Condition Index (WVSCI) of the WVDEP Save Our Stream Protocol. It is recommended this portion of Part I be completed for perennial and intermittent stream classifications. In the event this data cannot be obtained (i.e. ephemeral stream), the metric will generate an index score based upon the Physical and Chemical Indicators.

COLUMN No. 2 – Mitigation Existing Condition (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 2. This column is utilized to establish the baseline conditions for the mitigation site. In cases where an impact and mitigation will occur at the exact same site (i.e. sediment pond construction and restoration), this column should reflect baseline mitigation conditions as "0"[1].

Cell G5 - Select Mitigation Stream Classification

Cell I7 - Input Percent Stream Channel Slope for Mitigation Stream

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 3 – Mitigation Projected at Five Years Post Completion (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 3. This column is utilized to establish the projected condition of the site after five years of completion. Generally, there should not be a dramatic or substantial increase in functional unit scores between year 5 and 10 projected assessments (i.e. the duration of total stream buffer revegetation will typically be the last element to reach maturity for optimal functional input). The five year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions (when it is determined five years of monitoring is appropriate by USACE).

For example purposes, a sediment pond restoration site (mitigation site) which formerly required total elimination of the riparian vegetative buffer and received a full re-vegetation application of native tree, shrub and grass stratum species would be expected to score within the following USEPA RBP individual parameter ranges (High Gradient Data Sheet) after five years of restoration.

USEPA RBP

Epifaunal Substrate	Embeddedness	Velocity Depth Regime	Sediment Deposition	Channel Flow Status	Channel Alteration	Frequency of Riffles	Bank Stability (LB&RB)	Vetetative Protection (LB&RB)	Riparian Vegetative Zone (LB&RB)
8-12	8-12	6-10	8-13	0-20	11-15	11-18	12-16	8-12	0-20

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 4 – Mitigation Projected at Ten Years Post Completion (Credit) - All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 4. This column is utilized to establish the projected condition of the site after ten years of completion. The ten year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions. The ten year post-completion benchmark is also utilized to clearly identify performance standards and success criteria, which will be incorporated into Department of the Army Permits as special conditions (when it is determined ten years of monitoring is appropriate by USACE).

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

COLUMN No. 5– Mitigation Projected Upon Maturity (Credit)
All projects proposing compensatory mitigation (credit) to waters of the U.S. shall enter data in Column No. 5. This column is utilized to establish the projected condition of the site at maturity. The full restoration of a riparian buffer zone may require 40 or more years of sustained growth to contribute detritus and large woody debris, and provide light and temperature regulation.

Part I – Physical, Chemical and Biological Indicators
*Reference Part I above.

PART II – Index and Unit Score - No data entry is required in Part II, the Index Score is multiplied by the linear feet of impact (debit) to generate a raw Unit Score.

Stream Parts III-VI

Part III- Impact Factors
Cell C8 [Temporal Loss-Construction] - Enter the number of years reflecting the duration of aquatic functional loss between the time of impact (debit) and completion of compensatory mitigation (credit). For example, if Permittee-Responsible On-site mitigation is proposed and it will be five (5) years before the mitigation will be completed then enter a “5”.

DEFAULT VALUES: The default value for ILF is 4 years and Mitigation Banking (provided Mitigation Bank credits have been approved and are available) is 0 years.

Cell C19 [Temporal Loss-Maturity] - Enter the number of years representing the period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. the full restoration of a riparian buffer zone may require 40 or more years of sustained growth to contribute detritus and large woody debris and provide light and temperature regulation).

Cell H7 [Long-term Protection] - Enter the number of years representing the period of protection proposed for the mitigation site. Long-term protection is obtained via conservation easements or deed restrictions to ensure sustainable gains in values. Perpetual protection should be entered as “101” or “Perpetual”.

DEFAULT VALUES: The default value for Mitigation Banking and/or ILF is “Perpetual” since these projects are required by the IRT to obtain perpetual protection.
Part IV- Comparison of Unit Scores and Projected Balance - No data entry is required. This part depicts the “Final Unit Score (debit)” in comparison with the Mitigation Existing Condition (credit), Mitigation Projected Upon Completion (credit) and the Mitigation Projected at Maturity (credit). The balance of the “Mitigation Projected at Maturity” shall be equal to or greater than the “Final Unit Score (debit)” to adequately offset the proposed impacts and be compliant with the national policy of “no net loss”.

Part IV- Index to Unit Score Conversion - No data entry is required. This section displays the final index score, which is utilized to generate a final debit unit score. For your convenience, this section also indicates the ILF amount that would be required to offset the final debit units.

*Note: All forms of compensatory mitigation now focus upon offsetting the final (debit) units rather than the linear feet except where the SWVM is not applicable (i.e. non-wadeable stream impacts).

Part V – Comparison of Unit Scores and Projected Balance - No data entry is required. This part depicts the "Final Unit Score (debit)" in comparison with the Mitigation Existing Condition-Baseline (credit), Mitigation Projected at Five Years (credit), Mitigation Projected at Ten Years (credit), and Mitigation Projected at Maturity (credit). Functional lift is defined as the balance between the "Mitigation Existing Condition-Baseline" and "Mitigation Projected at Maturity". The balance of the "Mitigation Projected at Maturity" shall be equal to or greater than the "Final Unit Score (debit)" to adequately offset the proposed impacts and be compliant with the national policy of "no net loss".

*Note: The yellow highlighted cells (Cells A43, C43 and D43) may be cut and copied to the next tab "Multiple Site Unit Comparison" for compiling data on multiple streams or stream segments. For submittal purposes, the Multiple Site Unit Comparison should be accompanied by individual Stream Valuation Metric spreadsheets for each stream or stream segment.

Part VI - Mitigation Considerations
Extent of Stream Restoration
Cells D32-D34 – Reference the IRT defined levels of Restoration and place an "x" in the appropriate Stream Restoration Level.

Extended Upland Buffer Zone
Cells F34-F37 – Insert the width of the buffer zone up to 150 feet from each stream channel side.

Cells H34-H35 and H37-H38 – Select from pull down box the class of buffer preservation and/or revegetation being performed.

Multiple Site Unit Comparison
When assessing multiple reaches or streams Cell Nos. A43-C43 should be copied and pasted into this table, which keeps a running tally of the debits and credits. When pasting choose "Paste Special" and then select "values and number format".

Wetland Valuation Metric:

Wetland Parts I-III

Cell B1 [USACE File No./Project Name] -Enter USACE File Number as well as the overall project name. Mining-related projects should also include the SMCRA Permit No in this field.

Cell L1 [Lat.] – Enter latitude coordinate in NAD 83 Decimal Degrees

Cell N1 [Long.] – Enter longitude coordinate in NAD 83 Decimal Degrees

Cell G2 [Stream/Site ID and Site Description] – Enter the wetland name, wetland identifier (which may correlate to a drawing), watershed acreage and riparian condition (i.e. mature tree stratum)

Cell B3 [Wetland Impact Acreage] – Enter the acreage of the impact

Cell F3 [Form of Mitigation] – Enter the form of mitigation. Choices are provided from the drop-down list

Cell M3 [Mitigation Acreage] – Enter the acreage of the compensatory mitigation proposed

Cell B4 [Date] – Enter date of the assessment being performed

Cell G3 [Weather Conditions] – Enter the weather conditions from the site during the assessment

Cell M4 [Precipitation Past 48 Hrs] – Enter the past 48 hrs precipitation for the site being assessed

Part I- Wetland Indicators
Cells A7 – A18 [Wetland ID] - Enter the wetland identification for each wetland impact (which may correspond to a drawing)

Cells B7 – B18 [Existing Classification] – Enter the wetland classification being assessed. Choices are provided from the drop-down list.

Cells D7 – D18 [Impacts] – Enter the amount of impacts (in acres) for each wetland.

Cells F7 –F18 [Mitigation Classification] – Enter the wetland classification being mitigated. Choices are provided from the drop-down list.
Part II- Unit Scores - No data entry is required. This part indicates the total Unit Scores or Replacement Units for each individual classification of wetlands.

Part III- Advanced Mitigation - Enter a "Yes" or "No" to indicate compensatory mitigation has been completed and determined sustainable in advance of any proposed impacts.

DEFAULT VALUES: Approved forms of advanced mitigation determined to be sustainable may be provided to offset impacts on a 1:1 ratio, within the same wetland classification.

Estimated In-Lieu Fee Costs – A comparison of the In-Lieu Fee costs associated with the proposed impacts is provided for reference purposes.

Wetland Parts IV-V

Part IV- Factors
Cell C6 [Temporal Loss-Construction] - Enter the number of years reflecting the duration of aquatic functional loss between the time of impact (debit) and completion of compensatory mitigation (credit). For example, if Permittee-Responsible On-site mitigation is proposed and it will be five (5) years before the mitigation will be completed then enter a "5".

DEFAULT VALUES: The default value for ILF is 4 years and Mitigation Banking (providing Mitigation Bank credits have been approved and are available) is 0 years.

Cell C17 [Temporal Loss-Maturity] - Enter the number of years representing the period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function.

Cell H5 [Long-term Protection] - Enter the number of years representing the period of protection proposed for the mitigation site. Long-term protection is obtained via conservation easements or deed restrictions to ensure sustainable gains in values. Perpetual protection should be entered as "101" or "Perpetual".

DEFAULT VALUES: The default value for Mitigation Banking and/or ILF is "Perpetual" since these projects are required to obtain perpetual protection.

Extended Upland Buffer Zone
Cells F16 – Insert the average width of the buffer zone up to 150 feet from wetland boundary.

Cells H16-H17 – Select from pull down box the class of buffer preservation and/or revegetation being performed.

Part V- Final Unit Score - This part is utilized as a reference for obtaining the Replacement Index (debit), Final Unit Score to Offset (credit) and the balance. The Final Unit Score has been adjusted to compensate for the factors input in Part IV and is the final figure necessary to be entirely offset by mitigation (credit).

Cell D25 [Form of Mitigation] – Enter the form of mitigation from the drop-down list.

Cells H25 – H28 [Applicant Input Mitigation (acres)] - Enter the acreage for each classification of wetland mitigation being proposed. The balance should be equal to or greater than the “Final Unit Score to Offset (credit)” to provide an adequate level of compensatory mitigation for offsetting the proposed impacts and be compliant with the national policy of “no net loss”.

EXHIBIT F

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

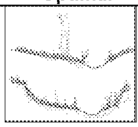
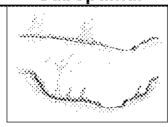
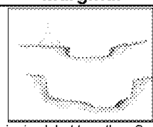
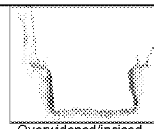
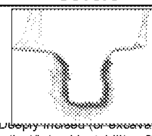
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor

Name(s) of Evaluator(s)	Stream Name and Information

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	
NOTES>>						

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							0%
	Score >							
Left Bank	% Riparian Area>							0%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	0.00	CI
Lt Bank CI >	0.00	0.00

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle poole complexes, stable features.

NOTES>>

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
							500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>>

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.00
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	0
CR = RCI X LF X IF	

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
								1

Name(s) of Evaluator(s)	Stream Name and Information

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							0%		
	Score >									
									CI= (Sum % RA * Scores*0.01)/2	
Left Bank	% Riparian Area>							0%	Rt Bank CI > 0.00	CI
	Score >								Lt Bank CI > 0.00	0.00

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.00
RCI= (Riparian CI)/2	
COMPENSATION REQUIREMENT (CR) >>	0
CR = RCI X LF X IF	

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Stream Assessment Summary Form (Form 2)

Unified Stream Methodology
for use in Virginia

Project #	Applicant		Date
Evaluators		HUC	Locality

Stream Name	Reach ID	Length of Impact (L_I) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) ($L_I \times RCI \times IF$)
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
	Total L_I	**0**		**Total CR**	**0**

Note: Round all feet & CR's to the nearest whole number.

Compensation Crediting Form (Form 3)

Unified Stream Methodology for use in Virginia

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	Reach #	Reach Length
							100

Name(s) of Evaluator(s)	Steam Name and Information

			Project Credits
Restoration: Includes Priority 1, 2, and 3 restoration activities. Does not include buffer width.		Credit per foot	0
List Reaches that will receive full Restoration:	Total length of Full Restoration	1	
	Credits = Stream Length X 1.0		
Enhancement With Instream Structures: Addressing Streambank Stability, Grade Control (Vanes, Weirs, Step-Pools), Constructed Riffles		Credit per foot	
Discuss Length Affected by Instream Structures (justify length):	Length Affected by Instream Structures	0.3	0
	Credits = Stream Length X 0.3		

Enhancement: Addressing Streambank Stability, Entrenchment Ratios, Access to Floodplain

Mitigation Categories

	Mechanical Bank Work			Biological Bank Work	
	Credit Per Length	Pick One Per Length		May Be Cumulative Per Length	
Activities	Habitat Structures	Create Bankfull Bench	Lay Back Banks	Bio-Remediation Techniques	Stream Bank Plantings
Credit per foot per bank	0.1	0.15	0.1	0.1	0.09

Right Bank	Length							0	
	Credit>								
Left Bank	Length							0	
	Credit >								

CREDITS			
Rt Bank >	0.00	Credit	
Lt Bank >	0.00	SUM of banks	0

Σ(Length X Credit) for all areas (banks done separately)

Riparian Areas: Assess the proposed 100 foot buffer on both banks based on the activity proposed. Enter the percentage of area and the credit below. (Widths of buffer above 100' will be determined below)

Activities	Buffer Re-establishment (removal of invasives)	Buffer Planting - Heavy	Buffer Planting - Light	Preservation *High Quality, Restoration, Enhancement*	Preservation *Low Quality*	Buffer area not within preservation width
Credit for 0'-100'	0.4	0.38	0.29	0.14	0.07	0
Credit for beyond 100'	0.2	0.19	0.15	0.07		0

Calculation of "Goal" riparian buffer for each side (SAR length times 100') >>>> 10,000 square feet

WITHIN FIRST 100' - Mitigation Categories

One vegetative community maintained	Subtract 0.03	Ensure the sums of % Riparian Blocks equal 100
Two vegetative communities maintained	Subtract 0.06	

Right Bank	Area #	1	2					
	Sq. Footage							
	% Area	0%	0%	0%	0%	0%	0%	0%
	Credit>							
Left Bank	Area #							
	Sq. Footage							
	% Area	0%	0%	0%	0%	0%	0%	0%
	Credit>							

CREDITS			
Rt Bank >	0.00	Credit	
Lt Bank >	0.00	0.00	0

Σ(% Area X Credit) for all areas (banks done separately)
AVE of credit for banks X length of project

Outside First 100' - Mitigation Categories

One vegetative community maintained	Subtract 0.03	Ensure the sums of % Riparian Blocks equal 100
Two vegetative communities maintained	Subtract 0.06	

Right Bank	Area #							
	Sq. Footage							
	% Area	0%	0%	0%	0%	0%	0%	0%
	Credit>							
Left Bank	Area #							
	Sq. Footage							
	% Area	0%	0	0	0	0	0	0%
	Credit >							

CREDITS			
Rt Bank >	0.00	Credit	
Lt Bank >	0.00	0.00	0

Σ(% Area X Credit) for all areas (banks done separately)
AVE of credit for banks X length of project

Adjustment Factors: These factors are applied as a multiplier to length of a reach for which they apply

Adjustment Factor Categories

Activity	Rare, Threatened, or Endangered Species or Communities	Livestock Exclusion	Watershed Preservation
Credit	0.1 - 0.3	0.1 - 0.3	0.1 - 0.3
Stream Length Affected			
Credit>			

Credits are cumulative and can apply to more than one reach. Each reach can have more than one Adjustment Factors

Record AF length /credit beneath the AF activity. Provide a narrative explanation of the applicable site conditions that warrant an adjustment and justify the AF credit chosen.

Credits > 0

ΣLength X Credit) for all areas

Total Compensation Credit Provided by Project 0

Compensation Summary Form (Form 4)

Unified Stream Methodology
for use in Virginia

Project #	Applicant	Date

Evaluators	HUC	Locality

Stream Name	Reach ID	Comp. Length (L_C) (feet)	Total Compensation Credit (Total CC) (From Form 3)
	Totals	**0**	**0**

Note: Round all feet & CC's to the nearest whole number.

Appendix B:

RESTORATION WORK PLAN

Mountain Valley Pipeline Project

TABLE OF CONTENTS

EXHIBITS

The purpose of this Restoration Work Plan is to provide details on procedures used at jurisdictional aquatic resource crossings and for the restoration of temporary stream and wetland impacts resulting from the construction of the Project. The successful restoration of temporary stream and wetland impacts, as described below, is an important factor in ensuring the Project's Performance Standards will be met.

1.0 LEGAL, REGULATORY, AND PERMIT REQUIREMENTS

1.1 Pre-construction Compliance Training

Mountain Valley will also conduct a resource-crossing training event for all field personnel before initiating any resource crossings. The training will document permitting requirements, agency notifications, restoration procedures, and monitoring commitments associated with the Project. Appropriate field personnel must have demonstrated experience with resource crossings, environmental controls, and environmental maintenance. New employees hired after the date of the planned pre-construction training will undergo the same training and be held to the same expectations.

1.2 Responsibility for Compliance with Requirements

Mountain Valley has the following expectations of *every person* employed on the Project and participating in stream and wetland crossings and other activities that impact aquatic resources:

- Know the legal, regulatory, and permit requirements applicable to their role in the Project.
- Comply with all legal, regulatory, and permit requirements at all times, without exception.
- Do not tolerate non-compliance by any other person employed on the Project.
- Immediately report any instances of non-compliance and/or unauthorized impacts to aquatic resources to the Project's Environmental Inspectors.

Every person employed on the Project has the *authority* and the *duty* to stop work if they witness any activities, conditions, or circumstances (1) that do not comply with any applicable legal, regulatory, or permit requirements or (2) which have or may cause an unauthorized impact to streams, wetlands, or other environmental resources.

1.3 Summary of Applicable Requirements

Restoration of stream and wetland impacts falls within the jurisdiction of several federal and state agencies. For reference, the table below lists the sources of applicable requirements for activities in and around streams and wetlands. Note that stream and wetland construction practices and erosion and sediment control measures are not addressed in this Restoration Work Plan except to the extent they specifically pertain to restoration.

Document	Agency	Relevant Activities	Reference Location
All Areas of Project			
Certificate Order, Mountain Valley Pipeline	Federal Energy Regulatory Commission (FERC)	• All activities	Relevant portion attached (App'x C: Environmental Conditions)
Wetland and Waterbody Construction and Mitigation Procedures	FERC	• Inspections • Stream & wetland crossings • Restoration • Monitoring	Construction Trailer & Field Tablets (digital version)
Upland Erosion Control, Revegetation and Maintenance Plan	FERC	• Upland work near streams & wetlands	Construction Trailer & Field Tablets (digital version)
Clean Water Act § 404/Rivers and Harbors Act § 10 Permit (*pending*)	U.S. Army Corps of Engineers	• Stream & wetland crossings • Restoration • Monitoring	To be attached upon issuance
Specific Areas			
Biological Opinion and Incidental Take Statement (2020)	U.S. Fish & Wildlife Service	• Monitoring	Relevant portion attached (Incidental Take Statement)
Right-of-Way Grant	Bureau of Land Management	<u>*MP 196.2 to 198.5 and 218.6 and 221.0*</u> • Upland work near streams & wetlands • Wetland crossings • Restoration	Construction Trailer (Spreads F & G)
Plan of Development	U.S. Forest Service	<u>*MP 196.2 to 198.5 and 218.6 and 221.0*</u> • Upland work near streams & wetlands • Wetland crossings • Restoration	Construction Trailer (Spreads F & G)
West Virginia Only			
Water Pollution Control Act Permit for Construction	WV Department of Environmental Protection (WVDEP)	• Inspections • Upland work near streams & wetlands • Stream & wetland crossings • Restoration • Monitoring	Construction Trailer & Field Tablets (digital version)

Document	Agency	Relevant Activities	Reference Location
Erosion and Sediment Control Plans	WVDEP	• Upland work near streams & wetlands • Stream & wetland crossings	Construction Trailer & Field Tablets (digital version)
Water Quality Certification (*pending*)	WVDEP	• Inspections • Stream & wetland crossings • Restoration • Monitoring	To be attached upon issuance
License and Right of Entry	WV Division of Natural Resources	Stream Crossings	Construction Trailer & Field Tablets (digital version)
Virginia Only			
Annual Standards and Specifications	VA Department of Environmental Quality (VADEQ)	• Inspections • Upland work near streams & wetlands • Stream & wetland crossings • Restoration	Construction Trailer & Field Tablets (digital version)
Erosion and Sediment Control Plans	VADEQ	• Inspections • Upland work near streams & wetlands • Stream & wetland crossings • Restoration	Construction Trailer & Field Tablets (digital version)
Stormwater Management Plans	VADEQ	• Inspections • Restoration • Monitoring	Construction Trailer & Field Tablets (digital version)
Upland Water Quality Certification	State Water Control Board (SWCB)	• Inspections • Upland work near streams & wetlands	Attached
Water Protection Permit (*pending*)	SWCB	• Inspections • Upland work near streams & wetlands • Stream & wetland crossings • Restoration • Monitoring	To be attached upon issuance

Document	Agency	Relevant Activities	Reference Location
Permit for Encroachment on State-Owned Submerged Lands (*modification pending*)	VA Marine Resources Commission (VMRC)	*Listed streams* • Stream & wetland crossings • Restoration	To be attached upon modification
Consent Decree	VADEQ	• Stream & wetland crossings • Monitoring	Relevant portion attached (Compliance Program)

2.0 PRE-CROSSING PROCEDURES

The process of ensuring the successful restoration of streams and wetlands begins *prior to* the initiation of the crossing. The following procedures must be followed to prepare for stream and wetland crossings.

2.1 Agency Notifications

Mountain Valley's Environmental Inspector (EI) is responsible for verifying all necessary pre-crossing notifications have been provided to regulatory agencies. These notifications enable the agencies to exercise oversight of crossings. The required notifications include the following:

Entire Project

- FERC – All crossings via weekly construction schedule updates

West Virginia

- Summers County Floodplain Coordinator (Greenbrier River trenchless crossing)
- WVDEP (Gary Kennedy) and Big Bend Public Supply District (John Kesler) – Greenbrier River crossing

Virginia

- VADEQ – Minimum of 48 hours before each crossing
- Western Virginia Water Authority – Roanoke River Crossing
- VMRC – All streams under VMRC jurisdiction

2.2 Pre-Construction Inspection

Prior to commencing the crossing, Mountain Valley's EI is required to complete the Pre-construction Resource Crossing Checklist (Exhibit A), which provides site-specific information and procedures to properly document pre-crossing conditions, ensure that the appropriate equipment and materials are on site, and ensure that everyone has reviewed procedures to successfully complete the crossing.

The pre-crossing inspection includes a visual inspection to confirm that site conditions have not materially changed since the baseline conditions assessment was completed. If the EI observes that conditions have changed, the crossing will not proceed until a new survey is completed to document the pre-crossing condition.

2.3 Waterbody Crossing Plan

It is the responsibility of the contractor to develop a site-specific Waterbody Crossing Plan for each crossing prior to the initiation of the crossing. The plan is intended to provide practical instructions for the construction crew that will be conducting the crossing and restoration activity. It will be developed in consideration of the following:

- Weather, flow, and other relevant site conditions at the time of the crossing;
- Pre-construction survey data, plan drawings, and/or other relevant information gathered through the Baseline Assessment, including the presence of any sensitive features (e.g., riffles and pools) that must be restored; and
- Applicable regulatory and permit requirements.

2.4 Pre-Crossing Field Meeting

An onsite pre-crossing field meeting will be held shortly (typically 24 to 48 hours) before commencing each stream or wetland crossing. The purpose of the pre-crossing field meeting is to ensure that all parties are in agreement about the plan and preparation for the crossing and restoration. The meeting will be attended by:

- Chief Environmental Inspector or their designee;
- Environmental Inspector;
- Construction Manager;
- Construction Foreman and Crew; and
- Others as appropriate (e.g., agency inspectors and staff, Environmental Auditor).

At the meeting, the parties will jointly review the following:

- Relevant regulatory or permit requirements;
- Suitability of the weather forecast, stream flow, and other site conditions for commencing the crossing;
- Waterbody Crossing Plan prepared by the contractor;
- Location of ordinary high water mark, setbacks, and vegetative buffers and, if necessary, refreshing flagging for same;
- Selected locations for stockpiling of the top 12 inches of stream substrate or wetland topsoil separately from subsoils (where necessary for the activity);
- Pre-construction Resource Crossing Checklist prepared by the EI;
- Equipment and materials on hand (e.g., pumps, dams, backup erosion and sediment controls) to verify that all are properly staged and operational;

- Erosion and sediment controls at the crossing site to ensure that they are installed in accordance with the erosion and sediment control plans;
- Sufficiency of the dewatering structure and discharge locations (where necessary for the activity);
- Placement and suitability of the temporary equipment bridge (where necessary);
- Task assignments and responsibilities for Construction Foreman and Crew; and
- Stop-work authority and procedures during implementation of the crossing and restoration activities.

The crossing will commence only if and when all parties attending the pre-crossing field meeting are in agreement as to the items in the list above.

3.0 RESTORATION PROCEDURES

This section outlines restoration procedures to be implemented to restore impacts. Where a restoration activity is intended to facilitate the eventual attainment of one or more Performance Standards (PS), that is noted in the text with a bracketed reference (e.g., [PS 1.0.7]).

3.1 Monitoring of Construction and Restoration Activities (All Activities)

Mountain Valley's EIs will provide onsite monitoring for all construction and restoration activities in streams and wetlands. Their responsibilities include, among other things, identifying and promptly remedying any deviations from the field crossing and restoration plan and applicable regulatory requirements.

Monitoring and oversight provided by the EIs is expected to support the eventual attainment of each applicable Performance Standard.

3.2 Restoration of Temporary Wetland Impacts (Trenches)

After the pipe is installed, the trench is backfilled with the native material that was removed during excavation [PS 1.0.3]. The upper 12 inches of topsoil that were segregated and stockpiled separately from the lower material will then be restored, de-compacted, and brought to match the pre-construction conditions [PS 1.0.1; 1.0.2; 1.0.3; 1.0.7; 1.0.8; 1.0.9]. Original surface hydrology will be re-established in wetlands by maintaining the existing overland flow patterns and surface contours of the surrounding areas [PS 1.0.7; 1.0.8]. Surface flow will not be directed away from the wetland. Trench breakers will be installed outside of the wetland limits to prevent subsurface drainage along the pipeline and to further support the development of hydric conditions [PS 1.0.7; 1.0.8].

Wetlands along the proposed pipeline are expected to exhibit varying degrees of saturation and water elevation, requiring a variety of plant species in order to be re-established. Wetlands will be temporarily seeded in accordance with the typical construction details and state-approved seed mixes [PS 1.0.5]. However, having segregated the upper 12 inches of topsoil will help support the natural restoration of the native seedbank [PS 1.0.1; 1.0.4; 1.0.5; 1.0.6]. Erosion and sediment control devices will be installed around the perimeter of the wetland until the area is stable with vegetation [PS 1.0.4; 1.0.6].

For all affected forested wetlands, restoration activities will be conducted in accordance with approved permit conditions, mitigation requirements, and Mountain Valley's Restoration and Rehabilitation Plan (Exhibit B) [PS 1.0.1; 1.0.4; 1.0.5; 1.0.6]. If saplings are required to be planted within the temporary right-of-way areas, this will be conducted in accordance with the approved erosion and sediment control plans and the Restoration and Rehabilitation Plan, unless otherwise specified by applicable permit conditions.

3.3 Restoration of Temporary Wetland Impacts (Timber Mats/Temporary Fill)

Wetland crossing structures, such as timber mats utilized to support equipment on the construction right-of-way, or other temporary fill material will be removed upon completion of construction. The timber mats will be lifted from and not pulled through the wetland further protecting the soils and native seedbank [PS 1.0.1; 1.0.2; 1.0.4; 1.0.6; 1.0.7]. The equipment used to remove the timber mats will work from upland areas or the existing timber mats – tracking out of the wetland until the mats are removed [PS 1.0.5; 1.0.9]. The area will then be de-compacted or scarified to support plant regrowth [PS 1.0.1; 1.0.2; 1.0.3; 1.0.4; 1.0.6; 1.0.7; 1.0.8; 1.0.9]. Additional seeding measures, if necessary, will be considered as part of the Adaptive Management Plan.

3.4 Restoration of Temporary Stream Impacts (Trenches)

To facilitate successful restoration of streams, the top 12 inches of the streambed substrate will be segregated and stockpiled separately from subsoils [PS 2.0.1; 2.0.3; 2.0.4; 2.0.5; 2.0.6; 2.0.7]. Work will proceed as quickly as practicable until the crossing is completed and the work area is restored. This practice ensures that the duration of temporary impacts to streams from pipeline installation work is minimized. Following pipe installation, the native subsoil material excavated from the trench will be used as backfill. Using the Baseline Assessment information, the stream will be installed to the pre-construction conditions using the cross-sectional and longitudinal profile information, with the segregated streambed substrate being replaced last [PS 2.0.1; 2.0.3; 2.0.4; 2.0.5; 2.0.6; 2.0.7]. Trench breakers of clay, earthen fill, or sand-filled sacks may be used to keep backfill from sloughing in toward the center of the stream and to prevent the pipeline bedding material from acting as a French drain [PS 2.0.1; 2.0.2; 2.0.3; 2.0.7]. The streambanks will be recontoured and stabilized [PS 2.0.2]. Once the EI has verified that the trench has been successfully backfilled and the upper 12 inches of stream substrate and streambanks have been restored to pre-construction contours, the downstream diversion will be removed, followed by the upstream diversion, restoring the natural flow of the stream [PS 2.0.4].

Steam banks and riparian areas will be seeded with the approved mixes applied at the required rates [PS 2.0.2]. In addition to the state and federal requirements, Mountain Valley has committed to handplanting within the portions of the Jefferson National Forest in Virginia, select forested wetlands and perennial streams in West Virginia and Virginia, loggerhead shrike foraging and nesting habitats in Virginia, and other specific upland areas in Virginia. Restoration of the bank and riparian areas would begin following the pipeline installation and continue until the vegetation is successfully established [PS 2.0.2].

3.5 Riffles, Pools, and Riffle-Pool Complexes (All Activities)

Special attention must be paid to the restoration of any riffles, pools, and riffle-pool complexes. Where the Baseline Assessment determined that these features are present in the pre-crossing conditions, these data will be used to restore the stream physical characteristics/morphology, including the pattern, profile, and dimensions, as close as practicable to the pre-crossing condition [PS 2.0.1; 2.0.3; 2.0.5; 2.0.6; 2.0.7]. This includes utilizing the pre-construction longitudinal profile to recreate riffle and pool sequences at slopes similar to those found pre-crossing data. The cross-section data collected as part of the baseline assessment will be utilized to restore dimensions in the impacted reaches. This material will be utilized to restore the stream's substate.

4.0 POST-RESTORATION PROCEDURES

4.1 Post-Construction Inspection

The EIs will conduct a post-construction inspection of each completed stream and wetland crossing to verify that the resource was appropriately restored. A state-specific Resource Crossing Inspection Form (Exhibit B) has been developed to standardize the inspection process. The form is completed in stages before, during, and after construction.

During the post-construction inspection, the EI must make a number of determinations, including the following.

For trenching activities:

- All welding, coating, and construction debris was removed from the crossing site;
- The top twelve inches of stream substrate or wetland topsoil was replaced last, on top of the backfilled subsoil; and
- Permanent trench breakers were installed in accordance with the approved plans.

For all restoration activities (e.g., trenching, timber-mat removal):

- All temporary and excess fill was removed from stream, wetland, and buffer areas;
- All disturbed areas were restored to pre-construction contours, including the restoration of riffles and pools;
- Streambanks, riparian areas, and/or wetland topsoils have been properly stabilized; and
- The disturbed area has been seeded with the appropriate permanent seed mix and/or planted with bare-root saplings (as required).

Once the area has been restored and all crossings (timber mats/temporary fills) have been removed, vehicular crossings of the resources are prohibited. Spanning of the resource is acceptable, provided additional fills are not located within the jurisdictional boundaries.

4.2 Corrective Action (If Necessary)

Any deficiencies observed by the EI during the installation or restoration of the crossing or during the post-construction inspection will be documented and promptly communicated to the Construction Foreman. The EI and Construction Foreman will consult on a plan to promptly remedy the deficiency. The corrective action will be undertaken immediately, or as soon as practicable if circumstances prevent immediate correction (e.g., end of authorized work hours, weather conditions). If the deficiency is attributable to human error or oversight, the EI will ensure that appropriate action is taken to prevent recurrence, through field instruction, additional offsite training, or other measures deemed necessary by the EI.

4.3 Subsequent Monitoring

Subsequent topographical survey and monitoring will be completed in accordance with the Monitoring Plan.

EXHIBIT A

Pre-construction Resource Crossing Checklist

Mountain Valley

Pre-construction Resource Crossing Checklist

Resource ID: Spread ID: Date:
Spread ID Crossing Length: Station Begin:
Anticipated Substrate: Station End:
TOYR? Yes☐ No☐ Other species of concern? T&E? Relocations? ____________
Project Commitment Considerations? List:____________

Crossing Preparations:

- ☐ Anticipated crossing date:
- ☐ Weather Forecast:
- ☐ Streamflow conditions:
- ☐ Waterbody Crossing Plan developed, authorized, and reviewed with crew.
- ☐ Pre-construction Photos Onsite and Reviewed.
- ☐ Identify Primary Crew personnel. Tie-In Crew Foreman: ____________
  Environmental Crew Foreman:____________
  Environmental Inspector: ____________
  Environmental Auditor (VA ONLY): ____________
- ☐ Identify locations for resource streambed soils and subsoil stockpiles.
- ☐ Adequate materials/measures are in -place / on-site to prevent mixing of resource topsoil.
- ☐ Trench dewatering locations are identified and verified.
- ☐ Streambed scour BMPs to be implemented (typical detail ID): ____________
- ☐ Pre-construction notifications submitted? Date:____________

Crossing Materials and Equipment

- ☐ Spill Kits, adequate number and sizes
- ☐ Pumps for "pump around"
- ☐ Cofferdam materials? If so, what?____________
- ☐ Flume pipe(s)? If so, size and number?____________
- ☐ (1) Backup pump for every pump in use for "pump around," verified working, fueled, and ready.
- ☐ Secondary containment for pumps, light plants, generators etc.
- ☐ Hoses/clamps/floats. Correct size, length, and condition for immediate use.
- ☐ Intake Screens.
- ☐ Energy Dissipator material
- ☐ Intake Floats
- ☐ Turbidity Curtains
- ☐ Sandbags
- ☐ Ladders
- ☐ Plastic Sheeting
- ☐ Trench Dewatering Pump(s)
- ☐ Filter Bags (appropriately sized)
- ☐ Straw Bales

☐ Geotech Material
☐ Trench Breaker(s)
☐ Any drain tiles, or other pre-existing conditions?
☐ Silt Fence
☐ Compost Filter Sock
☐ Erosion Control Fabric
☐ Permanent and Temporary Seed Mix
☐Native Cobbles for CWF streambed restoration? Sourced onsite or imported?

I hereby confirm that the above information is accurate to the best of my ability.

<u>Sign and Date:</u>

Tie-in Crew Foreman:_______________________________ ___________
Environmental Crew Foreman: _________________________ ___________
Environmental Inspector: ____________________________ ___________
Environmental Auditor (VA only): ______________________ ___________

EXHIBIT B
Restoration and Rehabilitation Plan

Mountain Valley Pipeline Project

Docket No. CP16-10-000

Restoration and Rehabilitation Plan

Revised September 2017

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1.0 Introduction

1.1 Project Description

Mountain Valley Pipeline, LLC (MVP), a joint venture of EQT Midstream Partners, LP, a subsidiary of NextEra Energy, Inc., Con Edison Gas Midstream, LLC, WGL Holdings, Inc., and RGC Midstream, LLC, plans to construct the Mountain Valley Pipeline (Project), an approximately 303-mile, 42-inch diameter natural gas pipeline, to provide timely, cost-effective access to the growing demand for natural gas for use by local distribution companies, industrial users and power generation in the Mid-Atlantic and southeastern markets, as well as potential markets in the Appalachian region. MVP is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act (NGA) authorizing it to construct and operate the proposed Project located in 17 counties in West Virginia and Virginia.

The proposed pipeline will extend from the existing Equitrans, L.P. transmission system and other natural gas facilities in Wetzel County, West Virginia to the existing Transcontinental Gas Pipe Line Company, LLC's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In addition to the pipeline, the Project will require approximately 171,600 horsepower (hp) of compression at three compressor stations currently planned along the route as well as measurement, regulation, and other ancillary facilities required for the safe operation of the pipeline. The pipeline is designed to transport up to 2.0 million dekatherms per day (MMDth/d) of natural gas.

The Project area consists of the temporary and permanent right-of-way (ROW) established for construction, operation, and maintenance of the pipeline, access roads, and aboveground facilities. The pipeline will require a 125-foot construction ROW and a 50-foot permanent, operational ROW. MVP will neck down to a 75-foot construction ROW in streams and wetlands wherever possible.

1.2 Project Timeline

Tree clearing is expected to occur as early as November 2017, continuing through May 31, 2018 and resuming August 1, 2018 through November 15, 2018. Pipeline construction will be completed by December 2018 with a target full in-service date for the Project of December 2018. Restoration will begin immediately following pipeline installation throughout the construction process and continue through June 2019, or until vegetation is successfully established.

1.3 Purpose of Plan

This *Restoration and Rehabilitation Plan* was prepared to address post-construction restoration, rehabilitation, and habitat mitigation activities. This plan will be implemented in conjunction with the FERC's 2013 *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and 2013 *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) as well as MVP's other construction, restoration, and mitigation plans (e.g., project-specific erosion and sedimentation control plans, *Spill Prevention, Control, and Countermeasure Plans, Karst Mitigation Plan,* and *Exotic and Invasive Species Control Plan*). The following sections provide details regarding MVP's proposed seed mixes, restoration procedures, maintenance and monitoring, and habitat enhancement within select areas of the Project.

2.0 Seed Mixes

MVP is partnering with the Wildlife Habitat Council (WHC), a nonprofit organization dedicated to assisting corporations, conservation organizations, and individuals with restoration and enhancement of wildlife habitat. The WHC is working with MVP on their commitment toward restoration of the Project ROW and establishment of perennial vegetation using native seed mixes created in collaboration with local seed supplier, Ernst Conservation Seeds, Inc. These seed mixes or an approved equivalent from another supplier will be applied along the Project's ROW except where landowners request a specific seed mix or on state or federally managed land where agencies request alternative seed mixes.

Proposed seed mixes will be distributed to representatives within state and federal agencies for approval and comment. These agencies include the United States Forest Service (USFS), West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), Virginia Department of Environmental Quality (VDEQ), and the Virginia Department of Conservation and Recreation – Division of Natural Heritage (VDCR-DNH).

2.1 Herbaceous Seed Mixes

A temporary cover crop containing annual ryegrass (*Lolium multiflorum* (*L. perenne var*)), german/foxtail millet (*Setaria italica*), cereal rye (*Secale cereale*) and/or browntop millet (*Panicum ramosum*) will be applied at 30 pounds per acre to prevent encroachment of non-favorable vegetation and provide erosion control until permanent vegetation can establish.

An upland herbaceous seed mix (Table 1) containing of forbs and grasses capable of establishing quickly to provide soil stabilization and revegetation will be applied at 20 pounds per acre in areas of the ROW not considered riparian, wetland, or within pollinator enhancement areas. In areas highly susceptible to erosion and characterized as steep slope, the upland mix will be applied at 45 pounds per acre. In West Virginia, slopes are considered steep when above a 3:1 grade (33%). In Virginia, the definition of a steep slope varies by county:

- Craig County – slopes greater than 20%
- Giles County – slopes greater than 25%
- Montgomery County – slopes greater than 33%
- Roanoke County – slopes greater than 25%
- Franklin County – slopes greater than 25%

- Pittsylvania County – slopes greater than 20%

Table 1. Upland, steep slope herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
Agrostis perennans	Autumn Bentgrass	3.15	3.15	5.5 - 7.5	Midsummer
Elymus virginicus	Virginia Wildrye	9.45	9.05	5.0 - 7.4	June to October
Panicum clandestinum	Deertongue	4.50	4.50	4.0 - 7.5	May to September
Schizachyrium scoparium	Little Bluestem	11.70	11.25	5.0 - 7.4	July to October
Sorghastrum nutans	Indiangrass	13.59	14.40	5.0 - 7.8	August to October
Asclepias syriaca	Common Milkweed	0.23	0.09		June to August
Aster novae-angliae	New England Aster	0.09	n/a	5.1 – 6.8	August to October
Aster pilosus	Heath Aster	0.05	0.05	5.4 - 7.0	After fall frost
Aster prenanthoides	Zigzag Aster	0.09	n/a	5.5 - 7.2	August to October
Chamaecrista fasciculata	Partridge Pea	n/a	0.45	5.5 - 7.5	July to September
Coreopsis lanceolata	Lanceleaf Coreopsis	0.45	0.45	6.0 - 7.0	April to July
Desmodium paniculatum	Panicledleaf Ticktrefoill	0.14	n/a	6.0 - 7.0	July to August
Eupatorium coelestinum	Mistflower	0.05	0.05	5.5 - 7.5	July to August
Heliopsis helianthoides	Oxeye Sunflower	0.36	0.45	5.5 – 7.0	July to August
Liatris graminifolia	Grassleaf Blazing Star	n/a	0.09	5.8 - 6.8	August to October
Monarda fistulosa	Wild Bergamot	0.18	0.23	6.0 - 8.0	June to September
Pycnanthemum incanum	Hoary Mountainmint	0.05	0.05	< 6.8	Summer
Rudbeckia hirta	Blackeyed Susan	0.45	0.45	6.0 - 7.0	May to July
Senna hebecarpa	Wild Senna	0.18	0.23		July to August
Solidago juncea	Early Goldenrod	0.09	n/a		June to July
Solidago nemoralis	Gray Goldenrod	0.14	0.05	6.5 - 7.5	August to September
Tradescantia ohiensis	Ohio Spiderwort	0.09	0.05		late April to mid-July
		45.00	**45.00**		

If this seed mix becomes unavailable, a different, similar mix, that also conforms with requirements from state and federal agencies may be substituted.

An herbaceous seed mix containing facultative wetland species will be applied to forested, emergent, and shrub/scrub wetlands where appropriate (Table 2). In forested wetlands, the herbaceous seed mix will be augmented with the planting of bare-root saplings and shrubs at specified distances from the pipeline centerline. See Section 5.3.1 for more details.

An herbaceous seed mixture containing warm season grass and wildflower species well suited to vegetate the banks of water features will be used within a 100-foot riparian buffer at perennial waterbody crossings (Table 3). At forested perennial stream crossings, a woody seed mixture specific to forest type will be applied with the herbaceous seed mix to temporary workspaces (see Section 2.2), and at 55 select perennial crossings planting of bare root seedlings will occur at specified distances from the pipeline centerline (see Section 5.3.1).

Table 2. Wetland herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
Alisma subcordatum	Mud Plantain	0.04	0.04	5.0 - 7.0	Midsummer
Asclepias incarnata	Swamp Milkweed	n/a	0.40		July to August
Aster novae-angliae	New England Aster	0.16	n/a		August to October
Aster prenanthoides	Zigzag Aster	0.14	n/a	5.5 - 7.2	August to October
Aster umbellatus	Flat Topped White Aster	0.10	n/a		August to Late Summer
Carex gynandra	Fringed Sedge	0.10	0.10		May to June
Carex lupulina	Hop Sedge	1.00	1.00	6.2 - 7.0	June to October
Carex lurida	Shallow Sedge	3.00	3.00	4.9 - 6.8	June to July
Carex scoparia	Blunt Broom Sedge	1.00	1.00	4.6 - 6.9	July to August
Carex vulpinoidea	Fox Sedge	7.00	6.90	6.8 - 8.9	June to August
Cinna arundinacea	Wood Reedgrass	0.40	0.40	4.0 - 8.5	August to September
Elymus virginicus	Virginia Wildrye	4.00	4.00	5.0 - 7.4	June to October
Eupatorium coelestinum	Mistflower	0.10	0.10	5.5 - 7.5	July to October
Eupatorium fistolosum	Joe Pye Weed	0.14	0.14	4.5 - 7.0	July to September
Eupatorium perfoliatum	Boneset	0.20	0.20		July to October
Helenium autumnale	Common Sneezeweed	n/a	0.10		July to October
Heliopsis helianthoides	Oxeye Sunflower	0.40	0.40		July to August
Juncus effusus	Soft Rush	0.60	0.60	5.5 - 7.0	May to June
Ludwigia alternifolia	Seedbox	0.10	0.10		August to September
Mimulus ringens	Square Stemmed Monkeyflower	0.10	0.10		June to September
Onoclea sensibilis	Sensitive Fern	0.20	0.20		June to October
Scirpus cyperinus	Woolgrass	0.20	0.20	4.8 - 7.2	July to September
Scirpus polyphyllus	Many-leaved Bulrush	0.20	0.20		July to August
Verbena hastata	Blue Vervain	0.72	0.72		June to October
Vernonia noveboracensis	New York Ironweed	0.10	0.10	4.5 - 8.0	July to September
		20.00	**20.00**		

If this seed mix becomes unavailable, a different, similar mix, that also conforms with requirements from state and federal agencies may be substituted.

Table 3. Riparian herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
Agrostis perennans	Autumn Bentgrass	0.54	0.04	5.5 - 7.5	Midsummer
Andropogon gerardii	Big Bluestem	3.00	0.01	6.0 - 7.5	July to October
Elymus virginicus	Virginia Wildrye	4.00	1.00	5.0 - 7.4	June to October
Juncus effusus	Soft Rush	0.20	3.00	5.5 - 7.0	May to June
Juncus tenuis	Path Rush	0.20	1.00	4.5 - 7.0	May to June
Panicum clandestinum	Deertongue	5.60	6.90	4.0 - 7.5	May to September
Sorghastrum nutans	Indiangrass	3.60	0.04	5.0 - 7.8	August to October
Asclepias incarnata	New England Aster	0.20	n/a	5.0 - 8.0	June to July
Aster novae-angliae	Swamp Milkweed	0.20	4.00	5.0 - 7.4	Late Summer
Chamaecrista fasciculata	Partridge Pea	n/a	0.60	5.5 - 7.5	July to September
Eupatorium coelestinum	Mistflower	0.20	0.20	5.5 - 7.5	July to October
Eupatorium fistolosum	Joe Pye Weed	0.14	0.20	4.5 - 7.0	July to September
Eupatorium perfoliatum	Boneset	0.10	0.20		July to October
Geum canadense	White Avens	0.20	0.40	4.5 - 7.5	May to June
Helenium autumnale	Common Sneezeweed	n/a	0.10	4.0 - 7.5	August to September
Heliopsis helianthoides	Oxeye Sunflower	0.40	0.14	4.5 – 7.0	July to August
Monarda fistulosa	Wild Bergamot	0.10	0.20	6.0 - 8.0	June to September
Pycnanthemum tenuifolium	Slender Mountainmint	0.06	0.10		July to September
Rudbeckia hirta	Blackeyed Susan	0.60	0.40	6.0 - 7.0	May to October
Senna hebecarpa	Wild Senna	0.08	0.10		July to August
Senna marilandica	Maryland Senna	0.08	n/a	4.0 - 7.0	Summer
Verbena hastata	Blue Vervain	0.40	0.10		June to October
Vernonia noveboracensis	New York Ironweed	0.10	0.72	4.5 - 8.0	July to September
		20.00	**20.00**		

If this seed mix becomes unavailable, a different, similar mix, that also conforms with requirements from state and federal agencies may be substituted.

Portions of the ROW within Braxton, Lewis, Fayette, and Nicholas counties, West Virginia and Giles and Montgomery counties, Virginia not considered as steep slope, riparian, or wetland will receive an herbaceous seed mix designed for native pollinators (Table 4). These select counties crossed by the Project contain either historical or extant records for presence of the federally endangered rusty patch bumblebee (*Bombus affinis*). MVP will voluntarily apply the aforementioned pollinator seed mix in an attempt to provide or enhance available foraging habitat necessary for the rusty patched bumblebee's recovery efforts in West Virginia and Virginia.

Table 4. Upland meadow, pollinator herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
Elymus virginicus	Virginia Wildrye	4.00	4.00	5.0 - 7.4	June to October
Schizachyrium scoparium	Little Bluestem	11.66	11.68	5.0 - 7.4	July to October
Sorghastrum nutans	Indiangrass	1.00	1.00	5.0 - 7.8	August to October
Asclepias syriaca	Common Milkweed	n/a	0.10	June to August	*Asclepias syriaca*
Asclepias tuberosa	Butterfly Milkweed	0.20	0.10	4.8 - 6.8	June to August
Aster novae-angliae	New England Aster	0.14	n/a	5.1 – 6.8	August to October
Chamaecrista fasciculata	Partridge Pea	n/a	0.60	5.5 - 7.5	July to September
Chamaecrista nictitans	Sensitive Partridge Pea	n/a	0.06		June to October
Coreopsis lanceolata	Lanceleaf Coreopsis	0.40	0.44	6.0 - 7.0	June to August
Echinacea purpurea	Purple Coneflower	0.60	n/a	6.5 - 7.2	Late Summer
Eupatorium coelestinum	Mistflower	0.10	0.04	5.5 - 7.5	July to October
Heliopsis helianthoides	Oxeye Sunflower	0.40	0.40	5.5 – 7.0	July to August
Lespedeza virginica	Slender Bushclover	n/a	0.10		July to September
Liatris graminifolia	Grassleaf Blazing Star	n/a	0.10	5.8 - 6.8	August to October
Liatris spicata	Marsh Blazing Star	0.16	n/a	5.6 - 7.5	July to September
Monarda fistulosa	Wild Bergamot	0.12	0.10	6.0 - 8.0	June to September
Parthenium integrifolium	Wild Quinine	0.10	n/a	unknown	Late May to Late August
Penstemon laevigatus	Appalachian Beardtongue	0.20	0.10	unknown	May to June
Pycnanthemum incanum	Hoary Mountainmint	0.04	0.20	< 6.8	Summer
Rudbeckia fulgida var. fulgida	Orange Coneflower	0.04	0.02		July to October
Rudbeckia hirta	Blackeyed Susan	0.60	0.04	6.0 - 7.0	May to July
Senna hebecarpa	Wild Senna	0.10	0.60		July to August
Solidago juncea	Early Goldenrod	0.04	0.10		June to July
Solidago nemoralis	Gray Goldenrod	0.04	0.04	6.5 - 7.5	August to September
Tradescantia ohiensis	Ohio Spiderwort	0.06	0.04		Late April to Mid-July
Tradescantia virginiana	Virginia Spiderwort	n/a	0.10		late April to mid-July
		20.00	**20.00**		

If this seed mix becomes unavailable, a different, similar mix, that also conforms with requirements from state and federal agencies may be substituted.

2.2 Woody Seed Mix

Herbaceous seed mixes will be augmented with an oak-hickory forest woody seed mix to revegetate temporary workspaces and access roads within impacted forested areas. All species proposed within the woody seed mix are native to the Project area and are summarized in Table 5. At minimum, three of the five overstory, four of the seven understory, and two of the four shrub species will comprise the woody seed mix.

Table 5. Oak-hickory forest woody seed mix and recommended application rate.

Layer	Species	Common Name	Seeding Rate (lbs/acre)
Overstory	*Fagus grandifolia*	American Beech	0.3
	Liriodendron tulipifera	Tulip Poplar	0.3
	Pinus strobus	White Pine	0.3
	Pinus virginiana	Virginia Pine	0.3
	Prunus serotina	Black Cherry	0.3
Understory	*Amelanchier canadensis*	Canadian Serviceberry	0.3
	Cercis canadensis	Eastern Redbud	0.3
	Cornus florida	Flowering Dogwood	0.3
	Diospyros virginiana	Persimmon	0.3
	Ilex opaca	American Holly	0.3
	Nyssa sylvatica	Black Gum	0.3
	Sassafras albidum	Sassafras	0.3
Shrub	*Hamamelis virginiana*	Witch Hazel	0.3
	Lindera benzoin	Spicebush	0.3
	Vaccinium angustifolium	Lowbush Blueberry	0.3
	Viburnum acerifolium	Mapleleaf Viburnum	0.3
	Vitis aestivalis	Grape	0.3

2.3 Jefferson National Forest

MVP will follow the USFS's recommendations for restoration and rehabilitation of the permanent ROW, as defined in the Plan of Development, to reduce impacts to visual resources, in a manner that preserves MVP's ability to access, monitor, patrol, and inspect the ROW in accordance with PHMSA requirements (49 CFR Part 192). MVP consulted with the USFS regarding appropriate seed mixtures for use within the Jefferson National Forest (JNF). The USFS indicated that the initial goal of seeding on the JNF is to establish vegetative cover to minimize surface erosion and sedimentation, while the secondary goal is to establish an assortment of native species congruent with local ecological communities and benefits for wildlife and pollinators. Species recommended by the USFS (Appendix A) for use in upland, riparian, and steep slope areas are comparable to those species contained in the seed mixes prepared by Ernst Conservation Seeds, Inc. As such, MVP will apply the herbaceous seed mixes described in Section 2.1 in appropriate areas within the JNF.

In addition, MVP will add the woody seed mix described in Section 2.2 to herbaceous seed mixes applied within temporary workspaces of the ROW.

As requested by the USFS, all leguminous seeds shall be either pre-inoculated, or mixed with inoculant specified for use on that particular seed according to manufacturer's directions. Inoculants shall be manually applied at double the manufacturer's rate and inoculant shall be mixed with legume seed prior to mixing with other seeds. For hydroseeding, a minimum of five times the dry seeding rate of inoculant will be used.

3.0 Restoration Procedures

As mentioned above, MVP will follow the directions and requirements in FERC's Plan and Procedures during restoration efforts. However, MVP will also follow any requirements set forth by federal and state agencies where the Project crosses land under their jurisdiction. These additional requirements and measures that have been identified to-date have been incorporated into this plan.

3.1 Topsoil and Spoil Treatment

MVP will identify and segregate the topsoil layer from the subsoil layer as described in FERC's Plan and Procedures. Within residential, agricultural areas, and the JNF, MVP will prevent the mixing of topsoil and subsoil during construction by stripping topsoil from the permanent and temporary ROW during construction. The stockpiled topsoil and subsoil will be stored separately within the 125-foot construction ROW, and will be replaced in the proper order during backfilling and final grading in order to prevent mixing of the soil horizons. All stockpiled spoils will be stored at least 10 feet from waterbodies, and within approved construction areas (as required by FERC's Plan and Procedures). Erosion controls will be installed around stockpiled spoils to ensure that they do not erode and impact adjacent areas.

3.2 Installation of Erosion Controls

Temporary erosion Best Management Practices (BMPs) will be installed prior to construction activities that can disturb soils, and these BMPs will be inspected and maintained throughout the construction process. The inspections will be conducted on a daily basis in areas that are under active construction or equipment operation, on a weekly basis in areas where no active construction is currently occurring, and within 24 hours in areas that have just received a rainfall event of at least 0.5 inch. Any necessary repairs that are identified during these inspections will be conducted within 24 hours or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.

Inspection and repair of temporary erosion BMPs will continue until they are replaced by permanent erosion controls or until the area is restored. Temporary erosion BMPs include temporary slope breakers, sediment barriers, trench plugs, and mulch. As requested by the USFS for implementation on the JNF, erosion and sediment control BMPs will be promptly removed after soils are stable and vegetative cover is established.

Temporary slope breakers are intended to reduce runoff velocities and divert water to vegetated areas off the construction ROW. Temporary sediment barriers are installed to stop the movement of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive areas. As indicated in FERC's Plan, these structures can be constructed of materials such as soil (e.g., diversion ditches), sand bags, silt-fences, or other approved materials. As requested by the USFS, within the JNF silt fences reinforced with metal or plastic mesh will be avoided if possible. In the case of the temporary slope breaker, water will be directed to a stable well-vegetated area or to an energy-dissipating device. The required spacing for these controls will be outlined in erosion and sedimentation control sheets.

Temporary trench plugs are intended to segment a continuous open trench prior to backfilling in order to prevent pooling and movement of water along the open trench. These plugs will consist of unexcavated portions of the trench (i.e., undisturbed soils), compacted subsoils, sandbags, or some functional equivalent.

If permanent seeding cannot occur immediately following final grading, mulch will be applied to all disturbed slopes that have the potential to erode in order to stabilize the soil and to reduce wind and water erosion. Mulch will be spread uniformly over an affected area to at least 75 percent coverage at a rate of 2-4 tons/acre. In wetland areas FERC's Plan requires that mulch applications will be increased to 3 tons/acre. This rate can be increased or decreased on the JNF based on slope classes. The following describes the USFS requirements regarding mulch applications, which would be followed on the JNF:

- Materials will be certified weed free or be accompanied by vendor's test results for noxious weed content. Hay will not be used on the JNF.
- Seeded areas can be mulched with weed free straw at a rate of 2-4 tons/acre (hand spread or blown), fiber mulch hydro-seeded at 1-2 tons/acre or other appropriate material.
- Natural biodegradable products will be used and materials will be demonstrated to be free of invasive species, including but not limited to plants, pests, and pathogens.
- If the use of stabilization netting is required/permitted, wildlife friendly geotextiles will be used. These products must either be free of netting or netting must be made of 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. Plastic netting (such as polypropylene, nylon, polyethylene, and polyester), even if advertised as biodegradable, is not an acceptable alternative. Any netting used must also have a loose-weave design with movable joints between horizontal and vertical twines to reduce the chance for wildlife entanglement, injury, or death.
- Water used for any products that require mixing with water will come from a USFS-approved water source. The source of water must not be contaminated with non-native invasive organisms that could spread into streams.

Permanent erosion controls will be installed following completion of construction. Permanent erosion controls consist of vegetation, permanent trench breakers and slope breakers. The placement, number, and composition of these permanent erosion controls will be illustrated on the erosion and sediment control plans and supplemented as determined by the EI, the applicable land management agency, and the FERC Plan and Procedures.

3.3 Re-contouring

All disturbed areas will be regraded and re-contoured to blend into the surrounding landscape, reestablish natural drainage patterns, and be compatible with surrounding drainage patterns, except at locations where permanent changes in drainage will be required to prevent erosion, scour, and possible exposure of the pipeline. The emphasis during re-contouring will be returning the entire ROW to its approximate original contours, stabilize slopes, control surface drainage, and aesthetically blend the area with the contours of adjacent lands. The re-contouring and replacement of topsoil in areas of disturbed wetlands to their original grade is especially critical to maintain wetland hydrology. If existing culverts are damaged or removed during construction, they will be replaced to their original condition in order to maintain the original hydrology.

3.4 Cleanup

Cleanup of an area (including final grading and installation of permanent erosion control structures) will be completed within 20 days after backfilling the trench (10 days in residential areas). All construction debris (e.g., mats, garbage, etc.) will be cleared from the construction area and disposed of in accordance with state and local regulations. Excess rock and spoil materials will be distributed along the construction ROW or disposed of in existing quarries or in permanent disposal sites. Hazardous materials will be handled and disposed of as described in the Project's *Hazardous Materials Management Plan*.

All non-merchantable brush and slash will be windrowed to the edge of the ROW, utilized in downslope areas of the ROW and access roads, burned and chipped, or removed from the area in accordance with local, state, or federal requirements. Windrowing of non-merchantable brush and slash along the ROW will result in habitat for many types of wildlife including: rabbits and other small mammals, ruffed grouse, song birds and reptiles. Over time the windrows will provide food for wildlife as insects will establish residence in the materials. The windrows can serve as escape cover from predators, locations for nesting and shelter from inclement weather. The windrows will generally range from 10 to 20 feet in width and 6 to 8 feet in height. Breaks will be left in the windrows at approximately 100 feet in order to provide for fire breaks and wildlife crossings.

Non-merchantable brush and slash can be utilized in downslope areas of the ROW and access roads to aide in soil stabilization and erosion control. Layering the brush and slash at the toe of a low-side slope along an access road provides for physical protection in the form of soil stabilization, and erosion and sediment control. Layering of brush and slash can promote physical protection to the downslope areas of the ROW. Additionally, the layering can provide long-term support for revegetation in downslope areas of the ROW.

3.5 Seeding

The goals of permanent seeding are to establish a dense, self-propagating, low maintenance ground cover in order to minimize erosion and sedimentation while also providing wildlife habitat.

Seeding will occur promptly after construction is complete; however, if ground conditions delay restoration until the following spring, the ground will be mulched and seeding will take place during the next growing season. A *Winter Construction Plan* has been prepared to address how restoration and revegetation would proceed if seeding could not be completed before the onset of winter. Additionally, if seeding must occur outside the normal seeding season a temporary erosion control seed mix will be applied, and either a permanent erosion control seed mix or native seed mix will be applied during the next normal seeding season. Seed will be uniformly applied using a broadcast seeder, drill, or hydroseeder. These methods are described in more detail below. When dryseeding, the seeding depth should be ¼ to ½ inch. Following application of seed mix, mulch will be applied as described in Section 3.5.5.

3.5.1 Seedbed Preparation

Areas targeted for restoration will be prepared for reseeding before applying the seed in order to establish an environment that is conductive to seed placement and moisture retention (as described in FERC's Plan and Procedures). Permanent erosion control devices will be installed to minimize the risk of erosion and mulch will be used to prevent soils from eroding or desiccating.

Soil compaction can reduce the likelihood of disturbed areas being successfully revegetated. In order to minimize soil compaction, construction activities will be timed to dry periods when possible, and construction mats will be used in wetland habitats. On the JNF, no heavy equipment will be used on plastic soils when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Also, on the JNF, heavy equipment will not be used during site preparation on sustained slopes over 35 percent, or on sustained slopes over 20 percent when soils have a high erosion hazard or are failure-prone. If compacted soils are identified by the EI or the USFS within areas targeted for restoration, the compacted soils will be ripped to a depth of at least 6 to 8 inches.

As stated in Section 3.1, MVP will identify and segregate the topsoil layer from the subsoil layer as described in FERC's Plan and Procedures. Stockpiled topsoil and subsoil will be stored separately, and will be replaced in the proper order during backfilling and final grading, and prior to seeding. Following topsoil placement, dry fertilizer and lime will be applied. Unless site-specific recommendations are received from local, state or federal agencies, MVP will incorporate up to 4,000 lbs/acre of agricultural lime and 500 lbs/acre of 10-20-10 (Nitrogen [N], Phosphorous [P], Potassium [K]) fertilizer into the soil.

The following are guidelines for fertilizer and lime application rates recommended by the USFS to be used on JNF:

Fertilizer:

- 600 – 800 lbs/acre of 10-20-10 (N-P-K)) fertilizer;
- 400 lbs/acre of 15-30-15 (N-P-K) fertilizer; or
- 800-1,000 lbs/acre of 10-10-10 (N-P-K)

Lime:

- 1,500-4,000 lbs/acre (pelletized or dust); or
- 4,000 lbs/ac of Hydro Lime (2.5 gal container is equivalent to 1000 lbs limestone; 5-10 containers /acre.

3.5.2 Drill Seeding

Drill seeding is a mechanical seeding method which places seed directly into the soil. Due to the equipment required; however, drill seeding is generally limited to areas with slopes less than 3:1 (USDA 2005). Because native seed mixes need to be drilled or otherwise covered to enhance germination success, drill seeding is the preferred option to be used in areas where a native seed mix will be applied.

3.5.3 Broadcast Seeding

Broadcast seeding will be the preferred seeding method used on steep slopes (i.e., slopes greater than 3:1) or other areas that cannot be accessed with other seeding equipment; areas that will be covered with erosion control fabric; or other areas determined to be appropriate for broadcast seeding by the EI and/or USFS. Seeds will be broadcast with a mechanical seeder immediately after the seedbed has been prepared and the soil is loose. This will allow the seeds to be lightly covered as the soil settles. The seeded area may also be disrupted by lightly dragging the area with chains or other appropriate harrows to lightly cover the seed. Broadcast seeding will occur immediately prior to installation of erosion control fabric or the application of mulch.

3.5.4 Hydroseeding

Hydroseeding may be used in upland areas that can be safely accessed with hydroseeding equipment, on slopes where drill seeding is not feasible (i.e., slopes greater than 3:1), and in areas determined to be appropriate for this method by the EI and/or USFS. Hydroseeding equipment shall be equipped with sufficient tanks, pumps, nozzles, and other devices required for mixing and hydraulically applying the seed, lime, fertilizer, wood fiber mulch, and tackifier mix in slurry form onto the prepared ground. The hydroseeding equipment shall have built-in agitators, which will keep the seed, mulch, tackifier, and water mixed homogeneously until pumped from the tank. Hydroseeding and hydromulching will be done from two directions (e.g., left and right or up and down), where feasible, to ensure maximum coverage of the soil. The amount of tackifier will be adjusted based on the slope of area being hydroseeded. For example, typical application rates for guar (a plant based tackifier) range from 40 lbs/acre for flat areas to 50 lbs/acre for 33 percent (3:1) slopes (CASQA 2003). During hydroseeding, it is recommended to add 50% more seed to the tank if a machinery breakdown occurs. Five times the recommended rate of inoculant will be used during hydroseeding.

In addition, the following USFS recommendations will be implemented in areas that are hydroseeded within the JNF:

- Hydroseeding will occur during a periods of dry weather, whenever possible, as wood-fiber hydraulic mulches are generally short-lived and require a 24-hour period to dry before rainfall occurs.
- Materials or additives used as binders or emulsifiers will not be toxic to soil organisms or otherwise prevent or inhibit seed germination.
- Only products suitable for wildlife will be used.
- Tackifiers will be non-toxic and organic based (e.g., guar, psyllium, or pitch and rosin emulsions).
- Tackifiers to be used, as well as, application rates, and methods of application will be submitted to the USFS for approval prior to use.

3.5.5 Mulching

After dry seeding, mulch will be applied to help the seed remain in place, protect seed from scavengers, and retain soil moisture. Mulch can consist of straw, erosion control fabric, or some functional equivalent, and will be certified as free of noxious weeds. Recommended loose mulch and application rates are provided in Table 6.

Table 6. Recommended mulch and application rates.

Mulch Application	Rate (lbs/acre)	Notes
Straw	4,000	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	1,500	Do not use as mulch for winter cover or during hot, dry periods. Apply as slurry.
Corn Stalks	8,000-12,000	Cut of shredded in 4 – 6 inch lengths. Air-dried. Do not use in fine turf areas. Apply with mulch blower or by hand
Wood Chips	8,000-12,000	Free of coarse matter. Air-dried. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand. Apply additional 12 lbs slow-release nitrogen/ton of wood chips.

3.5.6 Agricultural Lands

MVP will work with individual landowners to address restoration of active agricultural areas. Following construction, impacted agricultural land will be restored to pre-construction conditions in accordance with the FERC Plan, and any specific requirements identified by landowners, or state or federal agencies with regulatory jurisdiction over or interest in agricultural land. Agricultural land affected by the construction ROW and additional temporary workspace will be allowed to revert to prior use, with the exception of tree crops within the permanent ROW.

4.0 Bare-Root Sapling and Shrub Planting

Planting of bare-root saplings and shrubs will occur within select areas of the Project (Table 7 and Table 8) . The purpose of these plantings is to establish target native tree species comparable to the region, site characteristics (e.g., topography; soil characteristics; adjacent vegetation), and adjacent forest composition in order to encourage the timely reestablishment of habitat removed during Project construction. For small mammals and birds, adequate spacing of planted shrubs can form a large clump or thicket and provide excellent cover, refuge, or brood-rearing habitat often absent in open landscapes. Furthermore, planting a diverse array of native shrubs and saplings with varying blooming periods will provide reliable sources of pollen and nectar for pollinator species during spring, summer, and autumn.

All species planted will be native to the area, and the seed source or ecotype of the saplings and shrubs will be as local as possible with preference given to within-state, then mountainous regions of an adjacent state, followed by within the Appalachian Mountain range.

Handling and storage of saplings is important to ensure viability and to limit loss prior to planting. To the extent practicable, time between delivery of saplings to the restoration site and planting will be limited. In an effort to prevent desiccation and preserve moisture, saplings will be kept in original shipping container (e.g., sack; box) and stored in cool, moist, and shady locations not within direct sunlight and wind. Refrigerated storage will be used when possible. Only one bag or bundle of saplings will be opened at a time, and partially used bundles will be rolled or tied closed to prevent exposure of roots to air. Saplings will be protected from harsh materials such as gasoline, diesel fuels, oils, or other chemicals. Immediately prior to planting, saplings will be inspected for damage that may result in mortality. Saplings will be discarded if the following are present: broken stems or main roots, mold or mildew, stems with missing bark, desiccated roots, or a root system less than 5 inches long.

Saplings deemed suitable will be planted using a spade, auger, or dibble bar between October 1 and April 30 following seed mix application (Section 3.5). Only one sapling at a time will be removed from the planting bag after a suitable hole is dug. Holes will be dug to a depth where groundline is at approximate root collar level, typically between 8 and 10 inches. Before being placed in a vertical position within the debris-free hole, roots will be moistened and treated with root dip absorbent polymers and mycorrhizal root dip inoculates in accordance with manufacturer's recommendations. One sapling will be placed in each hole with the roots inserted to the bottom and then lifted upward slightly so that the root collar is at or slightly below the finished grade. Each sapling will be fertilized with a 5 gram tablet of controlled release fertilizer. The spade, planting bar, or shovel is inserted behind the planting hole and tilted back to close the bottom of the planting hole. The tool is then tilted forward to close the top of the hole. Soil will be firmly packed around each planting to fill any remaining voids. Tree tubes (minimum of 5 feet tall) will be used to protect saplings from browse damage caused by local wildlife or livestock. In areas experiencing higher than average browse damage or when planting species highly preferred by wildlife (e.g., apple, plum, hazelnut, or persimmon trees), 5- to 6-foot tall, 12- to14-gauge welded wire fence with 2-inch by 4-inch openings is recommended to protect saplings.

4.1 Riparian Stabilization and Restoration

The stabilization of streambanks and areas adjacent to waterbodies is critical to minimize the risk of erosion, slope failure, and impacts to sensitive aquatic species. In general, all affected riparian areas will be revegetated using native species and appropriate seeding prescriptions based upon the preexisting vegetative community within the disturbed area. MVP will restore waterbody banks to preconstruction contours to the extent practical following pipe installation and initial bank stabilization. Permanent bank stabilization and erosion control devices will be installed as necessary to minimize sediment deposition into waterbodies. Areas with steep slopes may require additional grading to reestablish contours capable of supporting preconstruction drainage patterns.

If grubbing has not been extensive, then native shrub and tree species are expected to sprout and regenerate naturally within temporary workspaces. To further avoid and minimize impacts to sensitive wildlife, temporary workspaces at select streams with known or potentially suitable habitat for sensitive aquatic species (i.e., freshwater mussels and fish) MVP is committed to be hand planting with bare-root live shrubs and tree saplings in addition to installing a prescribed herbaceous seed mix (Table 7).

Table 7. Stream crossings proposed for bare-root seedling plantings.

Waterbody Name	MP	County	State	Valuable Resource
Leading Creek	47.9	Lewis	WV	Headwaters of Group 2 Mussel Stream, warmwater
Sand Fork	55.1	Lewis	WV	Non-listed freshwater mussel stream, warmwater
Little Kanawha River	74.8, 74.9	Braxton	WV	Group 2 Mussel Stream, warmwater
Elk River	87.3	Webster	WV	Headwaters of Group 2 Mussel Stream, coldwater stream, B2 trout stream, Elk River Crayfish
Gauley River	118.9	Nicholas	WV	candy darter, warmwater stream, whitewater recreational uses
Hominy Creek	126.9, 127.0	Nicholas	WV	candy darter, coldwater stream, B2 trout stream
Meadow River	144.0	Greenbrier	WV	candy darter, B2 trout stream, Swainson's

Waterbody Name	MP	County	State	Valuable Resource
				Warbler
Greenbrier River	171.4	Summers	WV	Non-listed mussels, candy darter, warmwater stream
Indian Creek	182.7	Monroe	WV	possible hellbenders and mussels (historic); bald eagle
Kimballton Branch	199.1, 199.4	Giles	VA	headwaters of wild trout stream, coldwater stream
Stony Creek	200.4	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream
Little Stony Creek	204.4	Giles	VA	coldwater stream, wild trout stream
Sinking Creek	211.2	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream, non-listed mussels
UNT Craig Creek	219.2	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
UNT Craig Creek	219.3	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
UNT Craig Creek	219.8	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
UNT Craig Creek	220.0	Montgomery	VA	Headwaters of James spinymussel occurrences, USFS lands area
Mill Creek	222.2	Montgomery	VA	upstream of Roanoke logperch suitable habitat, orangefin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.2	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orangefin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.4	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orangefin madtom, coldwater stream, wild trout
Bradshaw Creek	230.7	Montgomery	VA	Roanoke logperch suitable habitat, orangefin madtom, coldwater stream, wild trout
Bradshaw Creek	231.5	Montgomery	VA	Roanoke logperch suitable habitat, orangefin madtom, coldwater stream, wild trout
Roanoke River	235.4	Montgomery	VA	Roanoke logperch present, orangefin madtom, non-listed mussels present
Bottom Creek	241.1	Roanoke	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Bottom Creek	242.5	Roanoke	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Mill Creek	245.1	Roanoke	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Green Creek	247.1	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout

Waterbody Name	MP	County	State	Valuable Resource
Green Creek	247.4	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
North Fork Blackwater River	249.7	Franklin	VA	Roanoke logperch suitable habitat, coldwater stream wild trout stream
Teels Creek	258.2	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	260.3	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.0	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.8	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	262.3	Franklin	VA	Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek contributing sediment impacts
Little Creek	262.6	Franklin	VA	Roanoke logperch suitable habitat, numerous crossings upstream contributing sediment impacts
Little Creek	263.3	Franklin	VA	Roanoke logperch suitable habitat, non-listed mussels present, numerous crossings upstream contributing sediment impacts
Maggodee Creek	269.4	Franklin	VA	Roanoke logperch suitable habitat
Blackwater River	269.7	Franklin	VA	Roanoke logperch present, non-listed mussels present
UNT to Jacks Creek	278.8	Franklin	VA	orangefin madtom
Turkey Creek	280.5	Franklin	VA	orangefin madtom
Strawfield Creek	282.3	Franklin	VA	orangefin madtom
Parrot Branch	282.9	Franklin	VA	orangefin madtom
Jonnikin Creek	284.4	Pittsylvania	VA	orangefin madtom
UNT to Rocky Creek	287.1	Pittsylvania	VA	orangefin madtom
Pigg River	289.1	Pittsylvania	VA	Roanoke logperch present, orangefin madtom, mussels present including yellow lampmussel (VA threatened)
Harpen Creek	289.9	Pittsylvania	VA	Roanoke logperch suitable habitat, orangefin madtom
Harpen Creek	292.0	Pittsylvania	VA	orangefin madtom

Table 8 lists suitable bare-root native tree and shrub species for use in restoring riparian areas and palustrine forested wetlands. The final species mix will depend on nursery stocks, availability, soil condition, and nearby species composition; however, six different tree species and four different shrub species, at minimum, will be planted at each riparian target area. In general, live, bare-root saplings and shrubs will be at least 18 inches in height, a minimum two years old, and planted no closer than 8 – 10 feet at a rate of approximately 300 to 500 stems per acre. A 10-foot strip centered on the pipeline will be maintained in an herbaceous state and no trees will be planted within 15 feet on either side of the pipeline to avoid the possibility of roots reaching the pipeline and compromising the integrity of the pipeline coating. A mix of shrubs and trees will be planted within the remaining sections of the ROW parallel to the waterbody and extending up to 100 feet, where possible, from the top of either side of the stream bank. Stream banks will be treated with lime and fertilizer, then the bare-root saplings and a riparian herbaceous cover seed will be applied and lightly covered with soil before mulch is added to the area. A sediment barrier will be maintained at the edge of the water until revegetation is successful. Plantings will be completed between October 1 and April 30 of the same year as construction, and no plantings will occur when soils are frozen.

Table 8. Native tree and shrub species for bare root plantings within riparian areas and forested wetlands.

Species	Common Name	Indicator Status	Riparian Planting	Forested Wetland Planting
Native Trees				
Acer rubrum	Red Maple	FAC	X	X
Acer saccharinum	Silver Maple	FACW	X	X
Betula nigra	River Birch	FACW	X	X
Carpinus caroliniana	American Hornbeam	FAC	X	X
Carya glabra	Pignut Hickory	FACU	X	
Carya ovata	Shagbark Hickory	FACU	X	
Chionanthus virginicus	White Fringe Tree	FAC+	X	
Diospyros virginiana	Common Persimmon	FAC-	X	
Fraxinus pennsylvanica	Green Ash	FACW	X	X
Juniperus virginiana	Eastern Red Cedar	FACU	X	X
Liquidambar styraciflua	Sweet Gum	FAC	X	X
Liriodendron tulipifera	Tuliptree	FACU	X	X
Nyssa sylvatica	Black Gum	FAC	X	
Platanus occidentalis	American Sycamore	FACW-	X	X
Populus deltoids	Eastern Cottonwood	FAC	X	
Quercus bicolor	Swamp White Oak	FACW+	X	X
Quercus falcata	Cherrybark Red Oak	FACW	X	X
Quercus phellos	Willow Oak	FAC+	X	X
Quercus nigra	Water Oak	FAC	X	
Quercus palustris	Pin Oak	FACW	X	X
Salix nigra	Black Willow	FACW	X	X
Ulmus americana	American Elm	FACW-	X	X
Native Shrubs				
Alnus serrulata	Brook-side Alder	OBL		X
Amelanchier canadensis	Canada Serviceberry	FAC	X	
Aronia arbutifolia	Red Chokecherry	FACW	X	X
Baccharis halimifolia	Groundsel Bush	FACW-	X	X
Cephalanthus occidentalis	Buttonbush	OBL		X

Species	Common Name	Indicator Status	Riparian Planting	Forested Wetland Planting
Cornus amomum	Silky Dogwood	FACW	X	X
Cornus stolonifera	Red-osier Dogwood	FAC	X	X
Hamamelis virginiana	American Witchhazel	FAC-	X	
Ilex verticillata	Common Winterberry	FACW+	X	X
Itea virginica	Virginia Willow	OBL		X
Iva frutescens	Marsh Elder	FACW+	X	X
Leucothoe racemosa	Fetter-bush	FACW	X	X
Lindera benzoin	Spicebush	FACW-	X	X
Lyonia ligustrina	Maleberry	FACW	X	X
Magnolia virginiana	Sweetbay Magnolia	FACW+	X	X
Physocarpus opulifolius	Eastern Ninebark	FACW-	X	X
Sambucus canadensis	American Elder	FACW-	X	X
Vaccinium corymbosum	Highbush Blueberry	FACW-	X	X
Virburnum dentatum	Arrow-wood	FAC	X	
Viburnum prunifolium	Black-haw	FACU	X	

4.2 Forested Wetlands

Bare-root saplings and shrubs (Table 8) will be planted in combination with an herbaceous wetland seed mix (Table 2) to ultimately restore of the impacted palustrine forested wetlands within the temporary ROW and the non-maintained portion of the permanent ROW to their pre-construction condition. Similarly, native shrubs (Table 8) will be planted in combination with an herbaceous wetland seed mix (Table 2) to revegetate the 50-foot-wide portion of the permanent ROW. The final species mix will depend on nursery stocks, availability, soil condition, and nearby species composition; however, six different tree species and four different shrub species, at minimum, will be planted at each forested wetland.

4.3 Loggerhead Shrike Foraging and Nesting Habitat

The Project is expected to impact a total of 57.04 hectares (140.95 ac) of habitat suitable for nesting and foraging, and 1.45 hectares (3.59 ac) of foraging habitat. Of this, 16.01 hectares (39.56 ac) of nesting and foraging habitat and 0.41 hectare (1.01 ac) of foraging habitat will be permanently impacted. Within the permanently impacted areas and temporarily impacted foraging habitat, a native herbaceous vegetation seed mix or landowner-approved seed mix matching pre-construction conditions will be used for revegetation. For temporarily, disturbed areas that are considered suitable for nesting and foraging, either of the aforementioned seed mixes will be used for revegetation along with planting of native shrubs/trees. As recommended by the VDGIF, native shrubs/trees removed from suitable habitat will be replaced with the same native species (e.g., eastern red cedar [*Juniperus virginiana*] will be replaced with eastern red cedar). Nonnative shrubs/trees that provide suitable nesting substrate and are removed as a result of Project-related activities will be replaced with its native, functional counterpart (e.g., Osage orange [*Maclura pomifera*], which is a nonnative, thorny tree, should be replaced with hawthorn [*Crataegus* spp.]). In some cases, it may be beneficial to promote a diversity of shrub/tree species in disturbed areas. For example, if an area is heavily dominated by eastern red cedar, MVP may choose to plant a combination of another native species (e.g., hawthorn) along with red cedar to avoid the potential loss of all red cedar in the event of a pest-infestation or spread of pathogen that may result in death of entire stands of the species. This may also be advantageous in areas where impaling stations (e.g., thorny vegetation; barbed wire) are limited.

Based on field habitat assessments and review of aerial imagery, approximately 1,225 preferred broadleaf shrubs/trees and 1,100 preferred coniferous shrubs/trees will be planted within temporarily disturbed nesting and foraging habitat (41.04 ha [101.41 ac]) and adjacent area (4.52 ha [11.16 ac]) to compensate for the removal of 1,221 broadleaf and 1,085 coniferous shrubs/trees. Shrubs/trees will be planted following completion of construction activities in suitable habitat. While quantity and general assemblage of shrubs and trees planted will be similar to pre-construction conditions, spatial arrangement of plantings will vary from where trees were removed. Spatial arrangement of plantings will be dependent on site conditions (e.g., topography; existing vegetation), proximity to the permanent ROW and roadways, planting technique, and what will best promote habitat enhancement for loggerhead shrike. Shrub/tree-planting efforts may focus more on areas with higher landowner-interest and engagement, as well as areas recommended by the VDGIF.

Of the shrubs/trees proposed for removal in suitable habitat, approximately 63.49 percent are of the preferred shrubs/trees noted by the VDGIF (i.e., eastern red cedar; hawthorn; black locust; Osage orange). MVP is committed to improving habitat quality where feasible and, therefore, have agreed to replace all removed shrubs/trees in suitable habitat in order to enhance conditions for loggerhead shrike. Increasing the number of preferred shrubs/trees within areas containing suitable loggerhead shrike habitat will potentially enhance the overall quality of nesting habitat promoting the conservation of this state-threatened species.

5.0 Maintenance and Monitoring

5.1 Permanent Right-of-Way

A 50-foot-wide permanent ROW will be maintained in a grassland/low-shrub state above the pipeline by periodic mechanical mowing, cutting, and trimming. Mechanical removal of vegetation will not occur more frequently than every three years (per standard FERC procedures) and not during the period of April 15 to August 1 in order to avoid impacts to ground-nesting migratory birds. This permanent ROW will maintain MVP's access to the pipeline's routes for terrestrial patrols, visibility of the pipeline's route for aerial patrols, and maintaining access in the event of emergency repairs. In upland areas, trees or deep-rooted shrubs will not be allowed to grow within the 15 feet of either side of the centerline in order to maintain the integrity of the pipe. Within wetlands or adjacent to waterbodies, MVP will maintain vegetation in a 10-foot corridor centered over the pipeline by mechanical means. Vegetation maintenance is not expected to be required in agricultural areas.

MVP will monitor disturbed areas where seed mixes were applied after the first and second growing seasons to determine the success of revegetation. The permanently maintained ROW will be considered successfully restored when the soils have been stabilized, and a native vegetation community is established (i.e., native grasses and shallow-rooted shrubs). In agricultural areas of the permanent ROW, revegetation will be considered successful when the area has been revegetated and is similar to adjacent undisturbed areas within the same field. As needed, additional seed and fertilizer will be applied to areas where revegetation is not deemed successful.

Management and control of invasive species is critical if disturbed areas are to be successfully revegetated and restored, as invasive species can outcompete and exclude native species. MVP will utilize techniques approved by the FERC and USFS to control invasive species along the construction areas, which will include mechanical methods (e.g., pulling, mowing, disking, etc.) as well as chemical treatments (e.g., herbicides). MVP will comply with all local, state, and federal requirements related to the use of herbicides, including any requirements specified by the USFS on the JNF. See Section 5.4 below for more details

5.1.1 Jefferson National Forest

MVP will follow the USFS's recommendations for restoration and rehabilitation of the permanent ROW, as defined in the Plan of Development, to reduce impacts to visual resources, in a manner that preserves MVP's ability to access, monitor, patrol, and inspect the ROW in accordance with PHMSA requirements (49 CFR Part 192).

5.2 Temporary Right-of-Way

Along the portion of the Project allowed to return to pre-construction conditions (e.g., areas beyond the permanent ROW), successful restoration will be determined by monitoring reclaimed areas for up to two growing seasons and comparing them to adjacent, undisturbed areas. Restoration in these areas will be determined successful if the seeded areas germinate and demonstrate, over time, an ability to achieve species distribution and diversity comparable to the pre-established targeted conditions.

5.3 Bare-Root Sapling and Shrub Plantings

5.3.1 Riparian and Forested Wetland Restoration

Assuming a 70% survival rate (Davis et al. 2010), approximately 380 stems per acre per Planting Area (stems/ac/PA) are expected to be present following the Year 1 planting. During Year 2 (first growing season), habitat assessments will be performed to determine whether the expected average survived. If not, the ratio of surviving stems to total stems planted will be calculated to determine the stem survival rate. The actual survival rate will be used to determine the number of trees necessary to plant in Year 2 in order to achieve the desired average in Year 3. Annual habitat assessments will occur as necessary beyond Year 2 until an average of 300 stems/ac/PA have survived.

5.3.2 Loggerhead Shrike Shrub Plantings

MVP will monitor habitat restoration and enhancement activities by evaluating survival of planted shrubs/trees.

Planted shrubs/trees will be monitored for a minimum of two growing seasons following the initial planting. Planting efforts will be deemed successful with 70 percent survival of shrubs/trees initially planted. This threshold will ensure that there is a net gain in preferred shrubs/trees throughout the study area (i.e., Giles, Craig, Montgomery, and Roanoke counties, Virginia) to promote conservation of loggerhead shrike and other shrub-nesting birds. If survivability drops below this threshold between initial planting and the end of the second growing season, shrubs/trees will be replaced to meet the 70 percent threshold.

The purpose of shrub/tree planting is to promote shrub-nesting bird species, such as loggerhead shrike. Along with monitoring the survival of shrubs/trees, MVP will provide VDGIF with locations as well as pre-construction and post-planting photos of the restored areas so that VDGIF can conduct future surveys of the restored habitat areas.

5.4 Exotic and Invasive Plant Species Control

The introduction and spread of exotic, noxious, and/or invasive plant species can cause significant ecological and/or economic impacts (Pimentel et al. 2005). Excavation for pipeline placement and other construction activities expose the topsoil surface to potential entrance of exotic, noxious, and/or invasive plant species. This can occur either by physical transport onto the exposed soil site by way of equipment, machinery or vehicles, through windborne or wildlife dissemination of seeds, or by introduction of seeds or plant parts contained in mulch or straw bales. Physical disturbance of topsoil can also promote germination of seeds of nonnative, invasive vegetation that already occur in the local seed bed.

MVP will implement the following measures to prevent and control the introduction and spread of nonnative, invasive plant species during construction and operation of the Project:

- Identifying areas supporting significant populations of invasive plants;
- Pre-treating areas with invasive plants prior to construction;
- Avoiding the introduction and spread of invasive plants from construction activities;
- Selecting native seed mixes appropriate for local site conditions (e.g., soils) for restoration efforts;
- Post-construction monitoring of vegetation in areas disturbed by construction in order to identify potential invasive plant infestations;
- Addressing invasive plant infestations that manifest following construction and during restoration.

5.4.1 Pre-Construction Measures

Surveyors noted several non-native plant species during on-site field assessments along the Project's proposed route (Appendix B).

Problem areas will be flagged, staked, or otherwise marked for clear identification. Identifying these problem areas prior to construction will help reduce the potential risk of further spread of invasive plant infestations.

Mechanical (e.g., mowing) and/or chemical measures (i.e., herbicide-application) will be implemented in order to eradicate invasive plants from the identified problem areas. Specific measures will be determined based on site conditions, seasonality, proximity to sensitive resources (e.g., known occurrences of rusty patched bumble bee), and through consultation with appropriate agencies.

Herbicides can be a safe and effective means of controlling both perennial and annual invasive vegetation. MVP will coordinate with appropriate land management agencies when applying herbicides for invasive plant control. The preferred method will be spot application; however, large infestations may require a broader application. Use of herbicides will be dependent on a variety of factors related to specific species (e.g., annual or perennial; woody or herbaceous), site-characteristics (e.g., soils; proximity to wetlands/open water), time of year, and weather conditions. Herbicide-use will be restricted when invasive plant species occur in close proximity to documented occurrences of sensitive resources that may potentially be affected (e.g., rare, threatened, or endangered plants). Other control measures may be used to address invasive plants in areas where herbicide-use is restricted.

A variety of equipment may be used to apply herbicides and will all be inspected on a daily basis, maintained as needed, and in accordance with applicable regulations, including maintaining Safety Data Sheets for all herbicides/materials. For rough terrain and/or areas with low densities of invasive plant species, backpack sprayers or other hand application methods will be used. For open areas that require intensive work and allow access for vehicles, mounted sprayers may be used. Care will be given to avoid excessive quantities of an herbicide on any given site, to the extent practical. The amount of herbicide located at any given site will be dependent on the quantity and density of invasive plants present. All concentrate will be in approved containers and transported using measures to avoid tipping and spilling. Mixing of concentrate will be completed in upland areas away from waterbodies and wetlands (>100 ft), private wells (>200 ft; identified through assistance with landowner), karst features (>300 ft), and public wells (>400 ft).

MVP developed a Project-specific *Spill Prevention, Control, and Countermeasure Plan and Unanticipated Discover of Contamination Plan for Construction Activities* in West Virginia and Virginia. One goal of these documents is to avoid or minimize the risk and potential impact of hazardous material spills during construction and operation. All herbicide applicators/contractors will be responsible for keeping and maintaining spill kits in their vehicles and at herbicide storage areas to ensure quick response to any spills. Spills are handled based on the herbicide/material type, scale, and location of the spill. Priorities of addressing the spill are as follows, 1) ensure safety of personnel and public; 2) contain spill to minimize risk to the environment; 3) complete initial clean-up; and 4) conduct remediation activities. Any spills will be reported to appropriate agencies in accordance with applicable laws and agreements.

5.4.2 Construction Measures

All equipment used for construction will be cleaned and inspected before arriving on site, and the EI will verify that equipment is free of soil and debris that may harbor invasive plant propagules. Cleaning stations will be established along the Project in areas without sensitive resources (e.g., wetlands). All soil/debris is removed from equipment by hand or compressed air. Equipment is also cleaned prior to moving from one construction spread to the next. The EI will maintain a log documenting cleaning and inspection of equipment. Visual markers (e.g., stickers) will be used to identify that equipment has been cleaned and inspected.

Topsoil and vegetation cleared from areas with invasive plants will be marked and stockpiled adjacent to the areas from which they were removed to ensure propagules are not spread to other areas. Barriers will be placed around topsoil and vegetation to eliminate the risk of material being moved. Signs identifying that piles contain invasive plant materials will be placed on barriers. Materials will be returned to areas from which they were removed during the reclamation process. Only certified weed-free mulch, straw and hay bales will be used to construct sediment control devices during construction.

5.4.3 Post-Construction Measures

MVP will adhere to the FERC's Plan and Procedures. Monitoring measures included in these documents and those proposed in the following section will help ensure invasive plant species are identified and addressed through appropriate control measures. Mechanical and chemical control measures—dependent on species, time of year, and site characteristics—will be implemented to reduce the risk of invasive plants becoming heavily established in and adjacent to the Project footprint. MVP is committed to working with adjacent landowners to ensure Project activities have a limited potential to result in the establishment of novel invasive plant species.

Revegetation measures will be performed immediately following construction or the following spring/summer depending on soil conditions (i.e., frozen versus not frozen). MVP will reseed and replant areas of the permanent and temporary ROW using only native species (see Section 2.0).). Immediate revegetation, as soon as practical, will reduce the time that bare soil is exposed and, therefore, minimize the opportunity for invasive plant species to become established.

MVP will monitor the ROW annually after the first and second growing seasons following construction to allow for early detection of exotic or invasive species infestations. If invasive plant species are found in numbers that are substantially greater than adjacent locations, MVP will conduct selective eradications of those species. Mechanical and chemical control measures will be completed, to the degree feasible, prior to maturation of seeds of invasive plants to avoid seed dispersal. As previously mentioned with pre-treatment and preventative measures to control invasive plants, herbicide types will be determined based on species requiring control, time of year, and site characteristics. Spot application of herbicide is the preferred method; however, dense infestations may be more appropriately addressed with a broader application. All herbicides will be applied by applicators appropriately licensed or certified by the state in which the work is conducted. Following herbicide application and based on the specific persistence of the herbicide in the soil, areas treated will be seeded with a native seed mix.

When implementing chemical control measures, as previously mentioned, care is taken to avoid sensitive resources that may be affected by herbicides (e.g., rare, threatened, and/or endangered plants; existing or created habitat for rusty patched bumble bee). In these areas, mechanical control measures, such as mowing or cutting/pulling by hand, will be the preferred method. If these methods result in a disturbance to topsoil, native seed will be applied to the affected area to reduce the risk of subsequent invasive species establishment.

5.4.4 Jefferson National Forest

An Exotic and Invasive Species Control Plan was developed and included in MVP's Plan of Development for the JNF. The document provides four strategies that will be implemented to avoid and minimize the exotic and invasive species introduction and infestation: 1) identifying and subsequent treatment of exotic and invasive species occurring in the Project area prior to any Project-related disturbance; 2) avoiding transportation of exotic and invasive species propagules through cleaning equipment between construction sites, using certified weed-free mulch and straw bales, and using locally sourced topsoil; 3) monitoring and treating any exotic and invasive species encountered during construction and post-construction; and 4) using seed mixes that do not contain any invasive plant species and which have been approved by the USFS for use on the JNF.

MVP will avoid the introduction of novel invasive species and utilize pre- and post-construction techniques approved by the FERC and USFS to control invasive species along construction areas, which will include mechanical methods (e.g., pulling, mowing, disking, etc.) as well as chemical treatments (e.g., herbicides) on the JNF, as requested by the USFS. MVP will comply with all local, state, and federal requirements related to the use of herbicides, including any specified by the USFS on the JNF. Herbicides to be used on the JNF will be approved by the USFS prior to use. For additional details regarding exotic and invasive vegetation control and herbicide use, refer to the Plan of Development for the JNF.

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APPENDIX A
USFS RECOMMENDED SPECIES FOR SEED MIXES

Table 1. USFS recommended species for upland areas within the Jefferson National Forest.

Scientific Name	Common Name	Growth Habit	pH Preference
Non-native Species for Erosion Control			
Lolium perenne subsp. *multiflorum*	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (*Panicum ramosum*)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0
Setaria italica	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
Chasmanthium laxum[a]	Slender woodoats	Graminoid	4.5 – 7.0
Eragrostis spectabilis[a]	Purple lovegrass	Graminoid	4.0 – 7.5
Panicum virgatum	Switchgrass	Graminoid	4.5 – 8.0
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Tridens flavus[a]	Purpletop	Graminoid	4.5 – 6.5
Apocynum cannabinum[a]	Indian hemp	Forb	4.5 – 7.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Desmodium canadense	Showy ticktrefoil	Forb	wide tolerance
Desmodium paniculatum	Panicledleaf ticktrefoil	Forb	6.0 – 7.0
Elymus virginicus[b]	Virginia wildrye	Graminoid	5.0 – 7.4
Geum canadense[a]	White avens	Forb	4.5 – 7.5
Heliopsis helianthoides	Oxeye sunflower; Smooth oxeye	Forb	unknown
Monarda fistulosa[b]	Wild bergamot	Forb	6.0 – 8.0
Pycnanthemum spp.[b]	Mountain mint	Forb	unknown
Rubus allegheniensis[a]	Common blackberry; Allegheny blackberry	Forb/ Subshrub	4.6 – 7.5
Rudbeckia hirta	Blackeyed Susan	Forb	6.0 – 7.0
Solidago canadensis[a]	Canada goldenrod	Forb	4.8 – 7.5
Tradescantia virginiana[a]	Virginia spiderwort	Forb	4.0 – 8.0

a/ This species is more tolerant of low pH soils
b/ Species is a good choice for higher elevation (i.e., areas higher than 3,000 feet or lower sites where the presence of red spruce indicates cold conditions) areas.

Table 2. USFS recommended species for riparian areas within the Jefferson National Forest.

Scientific Name	Common Name	Habit	pH Preference
	Non-native Species for Erosion Control		
Lolium perenne subsp. multiflorum	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (Panicum ramosum)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0
Setaria italic	Foxtail millet	Graminoid	5.3 – 6.9
	Native Species		
Agrostis perennans	Autumn bentgrass; upland bentgrass	Graminoid	5.5 – 7.5
Elymus virginicus	Virginia Wildrye	Graminoid	5.0 - 7.4
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Asclepias incarnata	Swamp milkweed	Forb	5.0 – 8.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Eutrochium fistulosum (Eupatorium fistulosum)	Joe pye weed	Forb	4.5 – 7.0
Eupatorium maculatum	Spotted joe pye weed	Forb	5.5 – 7.0
Eupatorium perfoliatum	Boneset	Forb	unknown
Helenium autumnale	Common sneezeweed	Forb	4.0 – 7.5
Senna hebecarpa	Wild senna; American senna	Forb	unknown
Senna marilandica	Maryland senna	Forb / Subshrub	4.0 – 7.0
Vernonia noveboracensis	New York ironweed	Forb	4.5 -8.0

Table 3. USFS recommended species for steep slope areas within the Jefferson National Forest.

Scientific Name	Common Name	Growth Habit	pH Preference
	Non-native Species for Temporary Erosion Control		
Lolium perenne subsp. *multiflorum*	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (*Panicum ramosum*)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0
Setaria italic	Foxtail millet	Graminoid	5.3 – 6.9
	Native – Highly Preferred		
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Tridens flavus	Purpletop	Graminoid	4.5 – 6.5
	Native – Preferred		
Agrostis perennans	Autumn bentgrass; Upland bentgrass	Graminoid	5.5 – 7.5
Dichanthelium clandestinum	Deertongue	Graminoid	4.0 – 7.5
Elymus canadensis	Canada wildrye	Graminoid	5.0 – 7.9
Desmodium canadense	Showy ticktrefoil	Forb	wide tolerance
Heliopsis helianthoides	Oxeye sunflower; Smooth oxeye	Forb	unknown
Lespedeza virginica	Slender bushclover; Slender lespedeza	Forb	acid tolerant
Liatris spicata	Dense blazing star; Spiked gayfeather	Forb	5.6 - 7.5
Senna hebecarpa	Wild senna; American senna	Forb	unknown
	Native – Moderately Preferred		
Panicum virgatum	Switchgrass	Graminoid	4.5 – 8.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Rudbeckia hirta	Blackeyed Susan	Forb	6.0 – 7.0

APPENDIX B
LIST OF POTENTIAL EXOTIC AND INVASIVE PLANT SPECIES

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Amur Honeysuckle	*Lonicera maackii*	Shrub	Pastures, fields, forest, forest edges, roadsides
Autumn Olive	*Elaeagnus umbellata*	Shrub	Pastures, fields, roadsides
Asian Bittersweet	*Celastrus orbiculata*	Vine	Fields, forest edges, roadsides, grasslands
Beefsteak Plant	*Perilla frutescens*	Herb	Roadsides
Bell's Honeysuckle	*Lonicera bella*	Shrub	Fields, pastures, forest edge, roadsides
Bishop's Goutweed	*Aegopodium podagraria*	Herb	Forests
Border Privet	*Ligustrum obtusifolium*	Shrub	Old fields, forest gaps
Bradford Pear	*Pyrus calleryana*	Tree	Full sun, orchards, parks, roadsides, yards, forest edge
Brittle Naiad	*Najas minor*	Herb	Ponds, streams, lakes, wetlands
Bull Thistle	*Cirsium vulgare*	Herb	Pastures, fields
Bush Honeysuckles	*Lonicera* spp.	Shrub	Pastures, fields, forest edges, roadsides
Butter-and-Eggs	*Linaria vulgaris*	Herb	Fields, pastures, roadsides, disturbed areas
Canada Bluegrass	*Poa compressa*	Grass	Fields, pastures, forest edge, wet sites, forest openings, waste areas
Canada Thistle	*Cirsium arvense*	Herb	Pastures, fields
Celandine	*Chelidonium majus var. majus*	Herb	Fields, roadsides, waste areas, dry to moist woodlands
Cheatgrass	*Bromus tectorum*	Grass	Pastures, fields
Chinese Bushclover	*Lespedeza cuneata*	Herb	Roadsides, rights-of-way, old fields, pasture, woodlands
Chinese Privet	*Ligustrum sinense*	Shrub	Pastures, fields, forest, forest edges, roadsides
Chinese Wisteria	*Wisteria sinensis*	Woody Vine	Forest, forest edges, roadsides, disturbed areas
Chinese Yam	*Dioscorea oppositifolia*	Vine	Streambanks, floodplain forests
Cinnamon Vine	*Dioscorea polystachya*	Vine	Forests, woodlands, thickets
Colonial Bent-grass	*Agrostis capillaris*	Grass	Pastures, fields
Common Buckthorn	*Rhamnus catharticus*	Shrub	Wetlands, old fields
Common Chickweed	*Stellaria media*	Herb	Fields, floodplain forests, disturbed areas, waste areas
Common Privet	*Ligustrum vulgare*	Shrub	Forests, fields, rights-of-way
Common Reed	*Phragmites australis*	Grass	Wetlands
Common Sheep Sorrel	*Rumex acetosella*	Herb	Fields, roadsides, disturbed areas, waste areas
Common Velvetgrass	*Holcus lanatus*	Grass	Meadows, wetlands, riparian areas
Cork Tree	*Phellodendron japonicum*	Tree	Residential, parks, open woodlands, roadsides
Crown Vetch	*Coronilla varia*	Herb	Pastures, fields
Curled Thistle	*Carduus crispus*	Herb	Pastures, fields
Curlyleaf Pondweed	*Potamogeton crispus*	Herb	Wetlands, ponds, lakes
Cut-leaf Teasel	*Dipsacus laciniatus*	Herb	Fields, pastures, roadsides, waste areas
Dame's Rocket	*Hesperis matronalis*	Herb	Fields, forest edges

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Drooping Star of Bethlehem	*Ornithogalum nutans*	Herb	Fields, floodplains, waste areas
English Ivy	*Hedera helix*	Vine	Forests, disturbed areas
Eurasian Water-milfoil	*Myriophyllum spicatum*	Herb	Aquatic ponds, ditches, wetlands
European Barberry	*Berberis vulgaris*	Shrub	Forests, wetlands, pastures
European Privet	*Ligustrum vulgare*	Shrub	Pastures, fields, forests, forest edges, roadsides, streams
European Stinging Nettle	*Urtica dioica*	Herb	Stream edges, marsh, meadows, moist woodlands
Field Hawkweed	*Hieracium caespitosum*	Herb	Fields, pastures, prairies, waste areas, disturbed areas
Fiveleaf Akebia	*Akebia quinata*	Vine	Forests
Fuller's Teasel	*Dipsacus fullonum*	Herb	Riparian areas, meadows, fields, forest openings, disturbed areas
Garden Yellow-rocket	*Barbarea vulgaris*	Herb	Pastures, fields, roadsides, moist meadows
Garlic Mustard	*Alliaria petiolata*	Herb	Forests
Giant Hogweed	*Heracleum mantegazzianum*	Herb	Right-of-ways, riverbanks, ditches
Glossy Buckthorn	*Frangula alnus*	Shrub	Wetlands, old fields
Goatsrue	*Galaga officinalis*	Herb	Pastures, streambanks
Goldern Bamboo	*Phyllostachys aurea*	Grass	Roadsides, disturbed areas, forest openings, forest edge
Goutweed	*Aegopodium podagraria*	Herb	Forests, fields, pastures
Great Mullein	*Verbascum thapsus*	Herb	Fields, meadows, forests, roadsides, disturbed areas
Ground Ivy	*Glechoma hederacea*	Herb	Open forests, disturbed areas, waste areas, lawn
Guelder Rose	*Viburnum opulus*	Shrub	Forests, wetlands, fields
Gypsy-flower	*Cynoglossum officinale*	Herb	Fields, pastures, forest edge, roadsides, disturbed areas
Hairy Cat's Ear	*Hypochaeris radicata*	Herb	Fields, pastures, grasslands, roadsides, disturbed areas
Hydrilla	*Hydrilla verticulata*	Herb	Wetlands, ponds
Indian-strawberry	*Duchesnea indica*	Herb	Fields, prairies, open woodlands, disturbed areas
Ivy-leaved Speedwell	*Veronica hederifolia*	Herb	Fields, forest edge, roadsides, disturbed areas
Japanese Barberry	*Berberis thunbergii*	Shrub	Forests, wetlands, pastures
Japanese Bromegrass	*Bromus japonicus*	Grass	Pastures, fields
Japanese Honeysuckle	*Lonicera japonica*	Vine	Forests, wetlands, fields
Japenese Hops	*Humulus japonicus*	Vine	Roadsides, streambanks, drainage ditch, meadows, disturbed areas, waste areas
Japanese Knotweed	*Polygonum cuspidatum*	Shrubby herb	Wetlands, streambanks, roadsides
Japanese Spiraea	*Spiraea japonica*	Shrub	Fields, forest openings
Japanese Stilt Grass	*Microstegium vimineum*	Grass	Pastures, fields, forests, wetlands
Jetbed	*Rhodotypos scandens*	Shrub	Forests, forest edge, roadsides
Jimsonweed	*Datura stramonium*	Herb	Pastures, fields
Johnson Grass	*Sorghum halepense*	Grass	Fields, wetlands, open forests

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Kentucky Bluegrass	*Poa pratensis ssp. pratensis*	Grass	Fields, grasslands, forest edge
Kudzu	*Pueraria lobata*	Vine	Forests
Lesser Burdock	*Arctium minus*	Herb	Fields, meadows, disturbed areas
Lesser Celandine	*Ranunculus ficaria var. bulbifera*	Herb	Forests
Lesser Periwinkle	*Vinca minor*	Vine	Fields, forest edge, forest openings
Linden Arrowwood	*Viburnum dilatatum*	Shrub	Forests, wetlands, disturbed areas
Long-bristled Smartweed	*Persicaria longiseta*	Herb	Lawns, roadsides, wet meadows, waste areas
Maiden Grass	*Miscanthus sinensis*	Grass	Pastures, fields
Marsh Dewflower	*Murdannia keisak*	Herb	Wetlands
Meadow Brome	*Bromus commutatus*	Grass	Pastures, fields
Meadow Fescue	*Schedonorus pratensis*	Grass	Pastures, fields
Mile-a-minute Vine	*Polygonum perfoliatum*	Vine	Fields, forest edges, roadsides, ditches
Mimosa	*Albizia julibrissin*	Tree	Forest edges, residential areas, roadsides
Moneywort	*Lysimachia nummularia*	Herb	Moist forests, streambanks, wet meadows, wetlands, roadsides, fields
Multiflora Rose	*Rosa multiflora*	Shrub	Pastures, fields, forest edges
Musk Thistle	*Carduus nutans*	Herb	Pastures, fields
Nodding Plumeless-thistle	*Carduus nutans ssp. marcolepis*	Herb	Disturbed sites, waste areas, roadsides
Norway Maple	*Acer platanoides*	Tree	Forests
Oriental Bittersweet	*Celastrus orbiculatus*	Vine	Forest edges, old fields
Oriental Lady's Thumb	*Polygonum caespitosum var. longisetum*	Herb	Wetlands, floodplain forests, upland forests
Oxeye Daisy	*Leucanthemum vulgare*	Herb	Fields, pastures, grasslands, roadsides, disturbed areas
Parrot Feather	*Myriophyllum aquaticum*	Herb	Wetlands, ponds
Perennial Ryegrass	*Lolium perenne ssp. multiflorum*	Grass	Pastures, fields
Plumeless Thistle	*Carduus acanthoides*	Herb	Pastures, fields, roadsides
Poison-hemlock	*Conium maculatum*	Herb	Fields, pastures, roadsides, forest edge, degraded wetlands and prairies
Porcelain Berry	*Ampelopsis brevipedunculata*	Vine	Forests, stream banks, old fields
Poverty Brome	*Bromus sterilis*	Grass	Pastures, fields
Princess Tree	*Paulownia tomentosa*	Tree	Forests
Purple Crown-vetch	*Coronilla varia*	Herb	Pastures, fields, roadsides, utility right-of-ways
Purple Loosestrife	*Lythrum salicaria*	Herb	Aquatic ponds, ditches, wetlands
Reed Canary Grass	*Phalaris arundinacea*	Grass	Wetlands
Rough Bluegrass	*Poa trivialis*	Grass	Pastures, fields, roadsides,
Russian Olive	*Elaeagnus angustifolia*	Shrub	Pastures, fields, roadsides

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Rye Brome	*Bromus secalinus*	Grass	Pastures, fields
Shattercane	*Sorghum bicolor*	Grass	Pastures, fields
Shrubby Bushclover	*Lespedeza bicolor*	Shrub	Forest edges, field edges, forest openings
Siberian Elm	*Ulmus pumila*	Tree	Forests
Small Carpgrass	*Arthraxon hispidus*	Grass	Wetlands, ponds, streams, river floodplains
Smooth Brome	*Bromus inermis ssp. inermis var. inermis*	Grass	Fields, Pastures
Spotted Knapweed	*Centaurea stoebe ssp. micranthos*	Herb	Pastures, fields, roadsides
Star of Bethlehem	*Ornithogallum umbellatum*	Herb	Forests, fields
Standish's Honeysuckle	*Lonicera standishii*	Shrub	Fields, pastures, forest edge, roadsides, disturbed areas
St, John's-Wort	*Hypericum perforatum*	Herb	Fields, pastures, disturbed areas
Stonecrop	*Sedum sarmentosum*	Herb	Forest, forest edge
Sweetclover	*Melilotus officinalis*	Herb	Fields, pastures, roadsides, waste areas
Sycamore Maple	*Acer Pseudoplatanus*	Tree	Forests
Tall Fescue	*Schedonorus phoenix*	Grass	Pastures, fields
Tartarian Honeysuckle	*Lonicera tatarica*	Shrub	Pastures, fields, roadsides, utility right-of-ways, forest edge
Tree of Heaven	*Ailanthus altissima*	Tree	Forests
Viper's Bugloss	*Echium vulgare*	Herb	Pastures, fields, roadsides, waste areas
Water Chestnut	*Trapa natans*	Herb	Wetlands
Watercress	*Rorippa nasturtium-aquaticum*	Herb	Wetlands, streams, springs
Water Shield	*Brasenia schreberi*	Herb	Ponds, lakes
Wild Carrot	*Daucus carota*	Herb	Fields, pastures, roadsides, degraded prairie, forest edge
Wild Parsnip	*Pastinaca sativa*	Herb	Roadsides
Wine Berry	*Rubus phoenicolasius*	Shrub	Forests, fields
Winged Euonymus	*Euonymus alatus*	Shrub	Forests
Winter Creeper	*Euonymus fortunei*	Vine	Forests, fields
Wocheiner knapweed	*Centaurea nigrescens*	Herb	Fields, pastures, grasslands, field edge, open forests
Yellow Flag	*Iris pseudocorus*	Herb	Wetlands

Source: USDA (2015), VDCR-DNH (2015), WVDNR (2009), WVDNR (2010)

EXHIBIT C
Resource Crossing Inspection Form

Mountain Valley PIPELINE

WEST VIRGINIA RESOURCE CROSSING INSPECTION FORM

Resource ID: ______________ **Start Date:** ______________ **Completed Date:** ______________

Milepost: ______________ **Station:** ______________ **Classification:** ______________

Spread: ______________ **Weather:** ______________ **Stream Depth:** ______________

Item #	Pre-Construction		N/A	YES	NO
1.	Resource Name:				
	Stream: Pre-construction photos and survey taken (upstream, downstream, and crossing location)	Date: ______________	☐	☐	☐
	Wetland: Pre-construction photos and survey taken at crossing location	Date: ______________	☐	☐	☐
2.	Resource Crossing Checklist Complete?		☐	☐	☐
3.	24-hour Variance Request Anticipated?		☐	☐	☐
	If yes, FERC approval received?		☐	☐	☐
4.	Temporary equipment crossing to remain after resource crossing installation is complete?		☐	☐	☐
5.	Is chemical storage, equipment maintenance, equipment storage, refueling equipment stored at least 100-feet from the stream or wetland?		☐	☐	☐
6.	Stream crossings to be conducted during low-flow conditions, when possible		☐	☐	☐
7.a	Review local weather forecast for predicted storm events to occur with 72 hours of scheduled in-stream work?		☐	☐	☐
7.b	Are storm events forecast that have potential to impact in-stream work? (Specify in Notes)		☐	☐	☐
8.	Notification submitted to potable water supply intakes within 3 miles downstream (where applicable)? Date notification submitted:		☐	☐	☐

Notes:

Item #	Construction	N/A	YES	NO
1.	Are equipment mats or other suitable methods used to minimize soil compaction and disturbance in Wetlands? (FERC PROCEDURES)	☐	☐	☐
2.a	Was the top 1-foot of wetland soil or stream bed substrate segregated and stockpiled separate from trench spoils?	☐	☐	☐
2.b	For crossings that require blasting, wetland topsoil/stream bed substrate must be segregated PRIOR to drilling of bore holes.	☐	☐	☐
3.	Are spoil piles located a minimum of 10-feet from the resource boundary with use of a sediment barrier? (FERC PROCEDURES)	☐	☐	☐
4.	Were permanent trench breakers installed at the banks of stream channels? (IP and FERC PROCEDURES)	☐	☐	☐
5.	Is water discharged from work area through a properly sized dewatering structure into a well-vegetated or otherwise stable area? (IP and FERC PROCEDURES)	☐	☐	☐

WEST VIRGINIA RESOURCE CROSSING INSPECTION FORM

6.	Is there adequate cover over the pipeline in accordance with DOT standards in 49 CFR 192.327and IP? Required Depth of Cover: _____ft.	☐	☐	☐
7.	Was scour mitigation installed per the "Vertical Scour and Lateral Channel Erosion Analysis" report? If so, what mitigation measures were installed? ______________________________	☐	☐	☐
8.	Top of pipe elevation measurements at the stream crossing and HMZ (if appropriate) for scour analysis.	Elevation: ___________		
9.	Are drilling/blasting/rock excavation done in accordance with the General Blasting Plan? (Sections 7.5 and 7.7)	☐	☐	☐
10.	Was excavated material backfilled in the proper order or if not utilized for backfill, removed and disposed of at an upland site? (IP)	☐	☐	☐

Notes:

Item #	Restoration	N/A	YES	NO
1.	Was in-stream work conducted as continuous activity to minimize crossing duration? (FERC PROCEDURES, IP)	☐	☐	☐
2.	Was all welding and coating debris fully removed from waterbody crossing prior returning flow to the waterbody?	☐	☐	☐
3.	Was the top 1-foot of stream substrate segregated during excavation of the stream utilized during restoration of the stream channel? (FERC PROCEDURES, IP)	☐	☐	☐
4.	Were disturbed areas within riparian buffers restored to pre-construction contours? (FERC PROCEDURES, IP)	☐	☐	☐
5.	Is this stream slated to have bare root saplings installed following restoration? Sapling plantings will be conducted outside of the crossing activity.	☐	☐	☐
6.	Was segregated wetland soil utilized for restoration of the upper 1-foot of the trench? (FERC PROCEDURES)	☐	☐	☐
7.	Was streambank stabilization and ESC fabric applied immediately following construction and prior to re-establishing the flow regime?	☐	☐	☐
8.	Was permanent seed applied to riparian areas and unsaturated wetlands at time of restoration?	☐	☐	☐
9.	Was the proper seed mix and application rate utilized and seed tags saved?	☐	☐	☐
10.	Do post-construction survey conditions meet pre-construction survey conditions in accordance with USACE IP permit conditions?	☐	☐	☐
11.	Was the resource crossing construction sequence adhered to as shown on the Approved ESC General Details?	☐	☐	☐

Notes:

This report was written by	____________________ *Print Name*	____________________ *Signature*	__________ *Date*

Insert photo pages

Mountain Valley PIPELINE

VIRGINIA RESOURCE CROSSING INSPECTION FORM

Wetland Studies and Solutions, Inc.® a DAVEY company

Resource ID: ______________ **Start Date:** ______________ **Completed Date:** ______________

Milepost: ______________ **Station:** ______________ **Classification:** ______________

Spread: ______________ **Weather:** ______________ **Bankfull Width:** ______________

Item #	Pre-Construction		N/A	YES	NO
1.	Survey Information:				
	Streams: Pre-construction thalweg data collected?	Date: ______________	☐	☐	☐
	Streams: Pre-construction cross-sections completed?	Date: ______________	☐	☐	☐
	Wetlands: Pre-construction 6" topo completed?	Date: ______________	☐	☐	☐
	Pre-construction photos taken (upstream, downstream and crossing location)?	Date: ______________	☐	☐	☐
2.	Is this resource a VMRC regulated stream?		☐	☐	☐
3.	Are the VMRC Stream Impact Plans and Cross-Sections (VA) or USACE requirements being adhered to? (IP, Standard JPA: Attachment H-5)		☐	☐	☐
4.	Are there any applicable crossing-specific conditions, including TOYRs, aquatic organism relocations, etc. (specify in Notes)?		☐	☐	☐
5.a	Is this resource a designated wild or stockable trout stream?		☐	☐	☐
5.b	Have fish and mussel species surveys and relocations been completed (where required)? (Specify in Notes)		☐	☐	☐
6.	Crossing Method implemented in accordance with the approved permit authorization (check one)? ☐ Dam & Pump (MVP-ES8 & MVP-15); ☐ Flume (VESCH 3.25-3 & MVP-6); ☐ Cofferdam (VESH 3.25-4 & MVP-ES13.1 -- ES13.2); ☐ Conventional Bore or Horizontal Directional Drill (HDD).				
7.	Have the appropriate agencies and parties been notified in accordance with permit conditions: (FERC, VDGIF, DEQ, DCR, USFWS, etc.)? NOTE: Minimum 48-hour notice required in VA (Consent Decree).		☐	☐	☐
8.	Stream crossings are to be conducted during seasonal low-flow conditions		☐	☐	☐
9.a	Review local weather forecast for predicted storm events to occur within 72 hours of in-stream work		☐	☐	☐
9.b	Are storm events forecast that have potential to impact in-stream work?		☐	☐	☐
10.	Written or electronic notification submitted to potable water supply intakes within 3 miles downstream (where applicable)? Date notification submitted:		☐	☐	☐
11.	Is chemical storage, equipment maintenance, equipment storage, refueling equipment stored at least 100-feet from the stream or wetland? (FERC PROCEDURES and AS&S)		☐	☐	☐

Notes:

Item #	Construction	N/A	YES	NO
1.	Are equipment mats or other suitable methods used to minimize soil compaction and disturbance in wetlands? (IP, FERC PROCEDURES, MVP-53)	☐	☐	☐
2.a	Was the top 1-foot of wetland soil or stream bed substrate segregated and stockpiled separate from trench spoils?	☐	☐	☐
2.b	For crossings that require blasting, wetland topsoil/stream bed substrate must be segregated PRIOR to drilling of bore holes.	☐	☐	☐
3.	Are spoil piles located a minimum of 10-feet from the resource boundary with use of a sediment barrier? (FERC PROCEDURES)	☐	☐	☐
4.	Were permanent trench breakers installed at the banks of stream channels or the ends of wetlands to prevent accumulated trench water from entering the waterbody? (IP, FERC PROCEDURES and MVP-20)	☐	☐	☐
5.	Is water discharged from work area through a proper dewatering structure into a well-vegetated or otherwise stabled area? (IP, FERC PROCEDURES and MVP-ES2)	☐	☐	☐
6.	Is there adequate cover over the pipeline in accordance with DOT standards in 49 CFR 192.327and IP? Required Depth of Cover: ______ft.	☐	☐	☐
7.	Was scour mitigation installed per the "Vertical Scour and Lateral Channel Erosion Analysis" report? If so, what mitigation measures were installed? ______________________________	☐	☐	☐
8.	Top of pipe elevation measurements at the stream crossing and HMZ (if appropriate) for scour analysis.	Elevation:__________		
9.	Is chemical storage, equipment maintenance, equipment storage, refueling equipment stored at least 100-feet from the stream or wetland? (FERC PROCEDURES and AS&S)	☐	☐	☐
10.	Are drilling/blasting/rock excavation done in accordance with the AS&S Appendix J: General Blasting Plan? (pg. 15; Sections 7.5 and 7.7)	☐	☐	☐
11.	Was excavated material backfilled in the proper order or if not utilized for backfill, removed and disposed of at an upland site? (IP & JPA Attachment H-2 pg. 5)	☐	☐	☐

Notes:

Item #	Restoration	N/A	YES	NO

Mountain Valley PIPELINE

VIRGINIA RESOURCE CROSSING INSPECTION FORM

Wetland Studies and Solutions, Inc.® a DAVEY company

1.	Was in-stream work conducted as continuous activity to minimize crossing duration? (FERC PROCEDURES and AS&S)	☐	☐	☐
2.	Was all welding and coating debris fully removed from waterbody crossing prior returning flow to the waterbody? (AS&S)	☐	☐	☐
3.	Was the top 1-foot of stream substrate segregated during excavation of the stream utilized during restoration of the stream channel? FERC PROCEDURES, IP)	☐	☐	☐
4.	Were disturbed areas within riparian buffers restored to pre-construction contours? (FERC PROCEDURES, IP)	☐	☐	☐
5.	Is this stream slated to have bare root saplings installed following restoration? (NOTE: Sapling plantings will be conducted separately from the crossing activity and completed at a later date.)	☐	☐	☐
6.	Was the segregated topsoil in wetland areas and streambed substrate utilized in restoration of the upper 1-foot of the trench? (FERC PROCEDURES)	☐	☐	☐
7.	Was streambank stabilization and ESC fabric applied immediately following construction (MS-15) and prior to re-establishing the flow regime in a Dam and Pump Method? (VESCH 3.22, VESCH 3.36, AS&S and MVP-23)	☐	☐	☐
8.	Was permanent seed applied to riparian areas and unsaturated wetlands? (IPand MVP-ES11.4 & ES11.5)	☐	☐	☐
9.	Use of fertilizer, lime, or mulch is prohibited in wetland areas. Was this condition adhered to? (FERC PROCEDURES).	☐	☐	☐
10.	Was the proper seed mix and application rate utilized and seed tags saved? (MVP ES11.4 & 11.5)	☐	☐	☐
11.	Was excess spoil material removed from stream and wetland areas (including buffers)?	☐	☐	☐
12.	Are properties and waterways adjacent to the project adequately protected from pollutant discharge, erosion, flooding, and sedimentation? (MS-19)	☐	☐	☐
13.	Do post-construction survey conditions meet pre-construction survey conditions in accordance with USACE IP permit conditions? (V: ±0.3 ft; H: ±1.0 ft)	☐	☐	☐
14	Were permanent water bars/slope breakers installed including a permanent waterbar within twenty-five feet from top of bank? (MVP-ES44.4 – ES44.8, MVP-17 and MVP-18)	☐	☐	☐
15.	Was the resource crossing construction sequence adhered to as shown on the Approved ESC General Details?	☐	☐	☐

Notes:

This report was written by	_______________ *Print Name*	_______________ *Signature*	_______________ *Date*

Resource ID: ___________ Spread: ___________ Date: ___________

Additional Notes:

Insert (4) photo pages
Add TOYR restriction dates as attachment

Appendix C:

PERFORMANCE STANDARDS

Mountain Valley Pipeline Project

TABLE OF CONTENTS

Appendix C:

PERFORMANCE STANDARDS

Mountain Valley Pipeline Project

This Appendix provides performance standards for the various metrics that will be monitored for wetlands and stream areas that are temporarily impacted by the construction of the Project and then subsequently restored.

Damage to the restoration areas by anthropogenic activities outside of Mountain Valley's control and/or wildlife species (such as deer or beaver) may require adjustment to the criteria for successful establishment of the resource. It also must be understood that some areas would not meet these understory and ground cover standards simply due to natural but abnormal conditions, such as extreme weather events; therefore, a reasonable determination would be made as to whether failure to meet the relevant standards is a result of a natural occurrence or whether it is an unsuccessful revegetation effort.

1.0 WETLAND ATTRIBUTES[1]

1.0.1 Cowardin Classification

The Cowardin Classification (Cowardin et al., 1979) for each impact area was determined during the delineation of each resource. Three wetland types - Palustrine Emergent (PEM), Palustrine Scrub-Shrub (PSS), and Palustrine Forest (PFO) - were identified. Conversion impacts to PSS and PFO have been mitigated through the purchase of advanced credits. The restoration goal is to restore each temporarily impacted wetland area to a condition such that it is on a trajectory to become, at maturity, a PEM (unless there is a specific restoration obligation in place that requires otherwise).

Notwithstanding the defined performance standard is to achieve a PEM wetland, where possible, temporarily-impacted wetlands that were previously PSS or PFO will be encouraged to return to that condition by leaving roots and stumps in the areas 15 feet outside pipeline which allows existing vegetation to recover more rapidly. To further support the re-development of PFO systems Mountain Valley will plant bare-root saplings and shrubs in impacted PFO in the temporary right-of-way (ROW). During the first monitoring event, a survival rate of approximately 400 stems per acre per planting area will be targeted. During the second monitoring event, habitat assessments will be performed to determine whether the expected average survived. If not, the ratio of surviving stems to total stems planted will be calculated to determine the stem-survival rate. The actual survival rate will be used to determine the number of plantings necessary achieve the desired average in the third monitoring event.

[1] Performance standards are based on the 2018 MBI Template developed by the Norfolk District USACE and the Virginia Department of Environmental Quality.

1.0.2 Area

The restored wetland area shall be greater than or equal to the original wetland area established in the baseline assessment.

1.0.3 Topographical Survey

The restored wetland area elevations shall be restored as close as practicable to the pre-construction contours to maintain the original wetland hydrology. This survey shall use the same horizontal and vertical datums used by the original data. If point data from the original data are not available, to be able to compare topography to this level of precision post-construction to the original topographic survey, a combination of interpolation using surfaces constructed from counter interval data and survey data outside of the limits of disturbance may be needed to calibrate and compare each survey to each other.

1.0.4 Dominant Vegetation

More than 50% of all dominant herbaceous plant species shall be facultative (FAC) or wetter (facultative wetland (FACW) or obligate wetland (OBL)). Wetland vegetation dominance is defined as a vegetation community where more than 50% of all dominant species are FAC or wetter using "routine delineation methods" as described in the 1987 Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0).

1.0.5 Invasive-Species

The restored wetlands area shall contain less than 5% aerial coverage of invasive species. The invasive species list for West Virginia is available on the West Virginia Division of Natural Resources website[2]. The list for Virginia is available through the Virginia Department of Conservation and Recreation.[3]

1.0.6 Native (Non-Invasive) Herbaceous Vegetation Coverage

Native or non-invasive herbaceous plant coverage shall be at least 70% by the end of the first growing season and subsequent monitoring years thereafter; unless shrub and/or canopy/crown coverage is at least 30%.

1.0.7 Hydric Soils

For restored wetlands where wetland soils were previously sampled to a minimum depth of 12 inches, positive indicators of hydric soil formation (see Field Indicators of Hydric Soils in the United States, Version 8.2 (NRCS, 2018)) must be present by the conclusion of the monitoring

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[2] West Virginia Invasive Species Strategic Plan and Voluntary Guidelines, 2014 (http://wvdnr.gov/wp-content/uploads/2021/04/West-Virginia-Invasive-Species-Strategic-Plan-2014-FINAL.pdf).
[3] NH_invasivePlantList_2014.indd (virginia.gov).

period post-construction within the first 6 inches for sandy (coarse textured) soils and within the first 12 inches for silts, clays, and loams. Restored wetlands that had refusal at 12 inches or less should also exhibit hydric soil development by the conclusion of the monitoring period; however, as these locations can be seen as problematic, evaluation of wetland restoration should consider procedures found in Chapter 5 of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (USACE, 2012).

The following standards specific to the soil type must be achieved:

(Required) For coarse-textured (sandy) surface soils, positive indicators of hydric soil formation must be demonstrated within six inches of the soil surface.

(Required) For fine-textured soils (silts, clays, loams), positive indicators of hydric soil formation must be demonstrated within 12 inches of the soil surface.

If the positive indicators of hydric soil formation identified above are not met, one of the following procedures may be considered to determine if hydric soils are present.

- For all monitoring years after reaching the final grade, piezometers or shallow wells demonstrate free water within 12 inches of the surface for 14 consecutive days during the growing season. Redoximorphic features must be present include, but are not limited to, redox concentrations, redox depletions, and reduced matrices.

- Demonstrate that positive tests with reagent occur within 60 percent or more of a specific layer in at least two or three soil samples. A reaction to alpha-alpha-Dipyridyl reagent must occur within a 2-inch layer of the upper 4 inches in soil that is inundated but not saturated, a 2.5-inch layer of the upper 5 inches in sandy textured soils, and a 4-inch layer of the upper 12 inches in clayey soils.

- A minimum of three of five "Indicator of Reduction in Soil" tubes must have 30 percent iron removed from a zone that is 6 inches or more thick. The zone of removal must begin within 6 inches of the soil surface for all soil textures.

1.0.8 Hydrology Indicators

The wetland hydrology standard shall be met if an area is inundated (flooded or ponded) or the water table is ≤12 inches below the soil surface for ≥14 consecutive days during the growing season. This can be determined with piezometers or shallow wells that demonstrate free water within 12 inches of the surface for 14 consecutive days during the growing season. Alternatively, the standard may be met by observation of the following wetland hydrology indicators:

For wetlands where Group A Hydrology Indicators (Observation of Surface Water or Saturated Soils) were observed, the standard will be deemed satisfied if these Group A Hydrology Indicators are present by the third full growing season after construction. Observations should be made during the growing season. Note that some locations may lack Group A Hydrology Indicators during the latter half of the growing season or during drier than normal years. This should be considered when evaluating sites that appear to be lacking previous hydrologic indicators. The growing season will be determined in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (USACE, 2012).

For wetland restoration areas that did not previously demonstrate Group A Hydrology Indicators, the standard will be deemed satisfied if other hydrologic indicators as listed on the Wetland Field Data Form are present by the third full growing season post-construction. Note that some locations may have been problematic prior to construction and evaluation of wetland restoration should consider procedures found in Chapter 5 of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (USACE, 2012).

1.0.9 Bulk Density

As stated in the Baseline Assessment, bulk density is assumed to not exceed root-growth restriction ranges and thus will not be measured during the baseline assessment. Bulk density may be measured during restoration if the Lead Environmental Inspector determines it is necessary or as part of the adaptive management strategy.

2.0 STREAM RESTORATION

Restored channels will be evaluated to determine if the performance standards have been successfully achieved during the monitoring period. These standards, outlined in Sections 2.0.1 and 2.0.2 below, have been developed to demonstrate that these overall objectives have been achieved:

1. Development and maintenance of a definable bed and bank.
2. Restoration of temporarily impacted streams to configurations that are hydrologically equivalent to what was present prior to stream crossings.

Development of the definable bed and bank will be evaluated utilizing visual observations and supported with physical survey data. A channel must be distinguishable upon visual inspection. This visually verifies the presence of stream channel which, in some instances, may not contain year-round flow.

The most common way to describe and quantify channel form is dimension, pattern, and profile. A longitudinal profile of the restoration area will be generated and will include the thalweg, water surface, and lowest bank, where feasible. These data will be used to compare stream pattern to verify that, within the monitoring period, the longitudinal profile of the restored reach is similar to the pre-crossing configuration.

The cross sections at benchmarked locations will be established in riffles, runs, or pools or in a configuration that can determine the maintenance of the defined channel in the restoration reach and that can demonstrate re-establishment of bed and banks as well as the thalweg (in cross sections). The post-construction reach will have dimension similar to pre-crossing configurations. Particle-size distribution and pebble-count data will be collected and utilized to determine change in substrate over time. Restoration reaches will be consistent with the pre-crossing form (will maintain D_{50} size class), as well as material present in upstream and downstream reaches (as applicable).

To be deemed successful, the restored stream reaches must have similar dimension, pattern, and profile to pre-crossing conditions. This will be achieved by comparing the data collected pre- and post-crossing. Locations that deviate greater than the performance requirements described below will be addressed utilizing Mountain Valley's adaptive management plan provided in Appendix E: Maintenance & Adaptive Management Plan.

2.0.1 Stream Survey

The following performance standards shall apply to streams[4]. However, recognizing that these are natural streams that may be influenced by conditions in the watershed outside of the control of Mountain Valley, if the streams (post-crossing) fail to meet the performance standards, but it can be demonstrated that there are conditions in the watershed affecting the stability of the stream, these performance standards may be waived by the applicable agencies. Similarly, if it can be demonstrated that the stream is in a state of "dynamic stability" (i.e., the stream is shifting due to natural conditions, but is stable), these performance standards may be waived by the applicable agencies.

a. Cross-sectional area

In the perennial streams, the stream cross-sectional area shall not increase or decrease by an amount greater than 25% of the baseline stream cross-sectional area. In the ephemeral and intermittent streams, the cross-sectional area shall be restored to a stable configuration based on the preconstruction contours and site conditions.

b. Pool-to-pool spacing

The pool-to-pool spacing shall not increase or decrease by an amount greater than 25% of the baseline surveyed pool-to-pool spacing range when more than one pool exists in the subject reach.

c. Maximum pool depth

In the perennial streams, the maximum pool depth shall not increase or decrease by an amount greater than 50% of the baseline surveyed pool depth (measured to bankfull elevation).

[4] Performance standards are based on the 2018 MBI Template developed by the Norfolk District USACOE and the Virginia Department of Environmental Quality.

In the ephemeral and intermittent streams, the maximum pool depth shall be restored to a stable configuration based on the preconstruction contours and site conditions.

d. Average riffle slope

The average slope of the riffle shall not increase or decrease by an amount greater than one tenth (0.1) of the slope determined by the baseline longitudinal survey or 0.4%, whichever is greater (e.g., a 4% baseline slope can allow a post construction riffle slope of +/- 0.4%, or a range from 3.6% to 4.4%; a 1% baseline slope can allow a post construction riffle slope of +/- 0.4%, or a range from 0.6% to 1.4%).

e. Average reach slope

The average slope of the reach shall not increase or decrease by an amount greater than one tenth of the slope determined by the baseline longitudinal survey or 0.4%, whichever is greater.

f. Pebble count

A reach-wide, representative pebble count will be completed post-construction and during the subsequent monitoring periods. The performance metric will be to maintain the same category as the baseline conditions.

2.0.2 Stream Bank Stabilization

Riparian buffer

As referenced in the Restoration Plan, Mountain Valley will stabilize and restore the riparian buffer adjacent to the stream crossings. A 70% survival rate at the areas having bare root saplings planted will be required. Herbaceous vegetation by native non/invasive species shall achieve 70 percent coverage unless canopy coverage reaches 30 percent.

Herbaceous vegetation by native non/invasive species shall achieve 70 percent coverage unless canopy coverage reaches 30 percent.

In areas where pre-crossing conditions were such that they preclude successful restoration, these performance standards shall not apply. Such conditions may include, but are not limited to, active agricultural fields or areas not fenced for livestock exclusion that may be grazed or otherwise affected

The restored area shall contain less than 5% aerial coverage of invasive species. The invasive species list for West Virginia is available on the West Virginia Division of Natural Resources website.[5] The list for Virginia is available through the Virginia Department of Conservation and Recreation.[6]

2.0.3 Stream Resource Valuation

Recognizing that these are natural streams that may be influenced by conditions in the watershed outside of the control of Mountain Valley, if the streams (post-crossing) fail to meet the performance standards, but it can be demonstrated that there are conditions in the watershed affecting the water quality of the stream, these performance standards may be waived by the appropriate agencies.

2.0.4 Field Water Quality

The following performance standards shall apply to streams, unless waived.

a. Dissolved Oxygen

In Virginia, levels will meet the baseline conditions or the state water-quality standards established at 9VAC25-260-50, i.e., a minimum of 4.0 mg/l in Class III and Class IV waters, a minimum of 5.0 mg/l in Class V waters, and a minimum of 6.0 mg/l in Class VI waters. In West Virginia, levels will meet the water-quality standards established at 47CSR2, i.e., a minimum of 5.0 mg/l in B1 waters, a minimum of 6.0 mg/l in B2 waters, and a minimum of 7.0 mg/l in spawning areas of B2 waters.

b. Specific conductivity

Virginia and West Virginia have not established state water-quality standards for specific conductivity. Therefore, specific conductivity must be between 0-1,500 uS/cm, the typical range of freshwater resources in the ecoregion., to meet the performance criteria.

c. pH

In Virginia, levels will meet the baseline conditions or the state water-quality standards established at 9VAC25-260-50, i.e., 6.0-9.0 in all Classes. In West Virginia, levels will meet the water-quality standards established at 47CSR2, 6.0-9.0 in all waters.

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[5] West Virginia Invasive Species Strategic Plan and Voluntary Guidelines, 2014 (http://wvdnr.gov/wp-content/uploads/2021/04/West-Virginia-Invasive-Species-Strategic-Plan-2014-FINAL.pdf)
[6] NH_invasivePlantList_2014.indd (virginia.gov)

2.0.5 Rapid Bioassessment Protocol (RBP)

It is anticipated that there will be variability in the RBP scores as the resources are restored and become reestablished. It is also anticipated that the scores will be maintained or improved and will progress in a positive manner. The information collected from the first monitoring event will be compared to the second monitoring event to determine if RBP habitat scores are being maintained or improved. The information collected from the second monitoring event will be compared to the third monitoring event to determine if RBP habitat scores are being maintained or improved. As this information is collected and compared, Mountain Valley will continue to work with the agencies to determine if the streams are approaching a satisfactory restoration based on the application of best professional judgment and expertise.

2.0.6 Benthic Macroinvertebrates

Post-construction surveys for benthic macroinvertebrates will be conducted and compared to the West Virginia Stream Condition Index. It is anticipated that there will be variability in these results. The information collected from the first monitoring event will be compared to the second monitoring event to identify the progression of macroinvertebrate occurrence. The information collected from the second monitoring event will be compared to the third monitoring event to determine if the scores are being maintained or improved. As this information is collected and compared, Mountain Valley will continue to work with the agencies to determine if the streams are approaching a satisfactory restoration based on the application of best professional judgment and expertise.

2.0.7 Hydrogeomorphic (HGM) Assessment

Similar to Sections 2.0.5 and 2.0.6, it is anticipated that there will be variability in the HGM scores as the resources are restored and become reestablished. The performance standards for this metric will also be measured the same, i.e., improvement in the scores is anticipated to occur from each monitoring event. As this information is collected and compared Mountain Valley will continue to work with the agencies to determine if the streams are approaching a satisfactory restoration based on the application of best professional judgment and expertise.

3.0 REFERENCES

Cowardin, L. M., Carter, V., Golet, F. C. & LaRoe, E. T. 1979. Classification of wetlands and deep water habitats of the United States. US Fish and Wildlife Service FWS/OBS 79/31.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. United States Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

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Appendix D:

MONITORING PLAN

Mountain Valley Pipeline Project

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APPENDIX D:

MONITORING PLAN

Mountain Valley Pipeline Project

INTRODUCTION

Assessments and surveys will be conducted for the restored stream and restored wetland crossings in the Project Area. Restored stream and wetland assessments and surveys will be initiated within the year following restoration activities at each crossing. Monitoring activities, except for the as-built survey, will be completed during the growing season. For the purpose of wetland monitoring, the growing season will be approximated as the timeframe after the last frost in the spring and before the first frost in the fall unless more specific methods are utilized, site-specific data are unavailable, other biological indicators for the growing season may be utilized which may include emergence of herbaceous plants from the ground; appearance of new growth from vegetative crowns (e.g., in graminoids, bulbs, and corms); coleoptile/cotyledon emergence from seed; bud burst on woody plants (i.e., some green foliage is visible between spreading bud scales); emergence or elongation of leaves of woody plants; or emergence or opening of flowers. The end of the growing season may be indicated as when woody deciduous species lose their leaves and/or the last herbaceous plants cease flowering and their leaves become dry or brown, generally in the fall due to cold temperatures or reduced moisture availability.

Monitoring will begin after completion of restoration activities. Annual monitoring will start during the growing season that commences after restoration completion (i.e., if the growing season starts March 15 and the restoration was completed June 30, the monitoring will start during the subsequent year's growing season). Longitudinal surveys of field conditions, cross-section analysis, and in-stream surveys will be completed for first year and visually monitored for each subsequent monitoring period, unless conditions indicate additional longitudinal surveys are required. The restored stream and wetland sites will then be evaluated on an annual basis for three years. If the relevant performance standards have been achieved for a site prior to the three-year commitment, Mountain Valley may request approval from the relevant regulatory agency overseeing the post-construction monitoring to discontinue monitoring of the resource. Confirmation in writing from Mountain Valley and concurrence from the United States Army Corps of Engineers (USACE), West Virginia Department of Environmental Protection (WVDEP), and Virginia Department of Environmental Quality (VADEQ) when Mountain Valley has satisfied the requirements of the restoration plan will end the monitoring period for this project.

Please note that Mountain Valley has a limited ability to conduct activities outside of the limits of disturbance (LOD) approved by the Federal Energy Regulatory Commission. Accordingly, field-data-collection activities will be limited to the specific LOD width for each crossing and require a modification from the standard reach lengths as outlined in both the U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (RBP) Manual (100-meter reach for

RBP/Benthic Macroinvertebrates) and the Hydrogeomorphic (HGM) Protocol (suggested 100-foot [ft] reach) and applicable state guidance. The assessment reach will be limited to the 75-ft LOD or less, depending on the proposed impact type (pipeline crossing, temporary or permanent access road, additional temporary workspace, or anode bed). Depending on the crossing angle, stream meanders, and other factors, the actual length of the stream reach available for survey within the LOD may be more or less than 75 ft.

1.0 WETLAND MONITORING

1.0.1 Cowardin Classification

Cowardin Classification (Cowardin et al., 1979) for each wetland will be determined using the Wetland Determination Data Form for that wetland. The delineator will record the existing Cowardin classification as well as the classification of the type of wetlands that the vegetation community suggests it is on a trajectory to achieve.

1.0.2 Wetland Area

The wetland areas will be delineated utilizing the USACE 1987 *Wetland Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* Version 2.0 (USACE, 2012). The delineated wetlands will be survey-located for comparison to the pre-construction area.

Photo documentation will occur during each sampling event. Specific photo locations are provided in **Table 1**. For wetland crossings or impacts, in addition to those listed in **Table 1**, the investigators will include various photographs of the restored wetland inside the LOD as well as conditions outside the LOD (based on size, shape, and total area of the restored wetlands). All photographs will be geo-referenced with GPS coordinates. Each crossing will include a photo location map indicating the specific location where photos were taken.

Table 1

Wetland Photo Location Requirements

Stream Type	Photographs
West Virginia Wetlands	
All Wetlands and Uplands	• Photos of cardinal directions at the center of the wetland • Photos of cardinal directions of each wetland pit • Photo of pit • Photo of core sample
Virginia and West Virginia Wetlands	
All Wetlands	• *WL-(#) – (#)* photos of the impacted wetland area inside the LOD • *EX COND – (#) – (#)* photos of the conditions outside the LOD

1.0.3 Topographical Survey

Mountain Valley will complete an as-built survey at each restored wetland crossing. If surface water is present, water elevation should be documented in addition to the surface of the wetland soil in cross-section. Hard control points should be established for future reference. Contour intervals should be a minimum of six inches with 25-ft grids and spot shots indicated if ground survey work is conducted versus aerial or remote sensing. Wherever possible, survey-grade spot shots will be taken outside of the LOD to assist in calibrating the datum of the pre-construction topographic survey with this post-construction topographic survey.

1.0.4 Dominant Vegetation

Dominant vegetation will be determined based on the methodology found in the USACE's *Wetland Delineation Manual* and recorded on the Wetland Determination Data Form for each wetland.

1.0.5 Invasive Species Cover

Invasive-species cover will be recorded on the Wetland Determination Data Form for each wetland. The delineator will also note and identify all invasive plant species and their percent cover located within the wetland but outside the data plot, if any.

1.0.6 Native (Non-Invasive) Herbaceous Vegetation Cover

Native herbaceous vegetation cover will be recorded on the Wetland Determination Data Form for each wetland.

1.0.7 Hydric Soils

The presence of hydric soils will be determined based on the methodology found in the USACE's *Wetland Delineation Manual* and recorded on the Wetland Determination Data Form for each wetland.

1.0.8 Hydrology Indicators

The presence of wetland hydrology indicators will be determined based on the methodology found in the USACE's *Wetland Delineation Manual* and recorded on the Wetland Determination Data Form for each wetland.

1.0.9 Bulk Density

As stated in Baseline Assessment Plan, bulk density is assumed to not exceed root growth restriction ranges and thus will not be measured during the baseline assessment. Bulk density may be measured during restoration if the Lead Environmental Inspector determines it is necessary or as part of the adaptive management strategy.

1.0.10 Wetland – Resource Evaluation

1.0.10.1 West Virginia Stream and Wetland Valuation Metric (WV SWVM)

No additional evaluations of wetlands are proposed using the WV SWVM, as the purpose (as it relates to wetlands) is solely for determining the mitigation for temporal loss. The post-restoration condition of wetlands shall be addressed via Sections 1.01-1.09 of this Appendix, as applicable.

2.0 STREAM ATTRIBUTE MONITORING

2.0.1 Stream Survey

Stream cross-sections, longitudinal profile, and pebble counts will be conducted in the same fashion as specified in the baseline assessment. The collected data will then be used to compare to baseline and/or previous monitoring years as applicable:

a. Stream cross-sectional area
b. Pool-to-pool spacing
c. Maximum pool depth
d. Average riffle slope
e. Average reach slope
f. Pebble counts

2.0.2 Stream Vegetation

Riparian buffer vegetation will be assessed using a 50-foot long, 5-foot wide belt transect placed above the top of bank. All woody stems within the transect will be counted to determine if the stem density requirement has been met. Herbaceous coverage will be visually assessed using a randomly placed $1m^2$ quadrat. Invasive species cover will be visually assessed within the riparian buffer to determine if the success criterion has been met. All observed invasive plant species and their approximate percent cover within the riparian area will be recorded.

2.0.3 Stream Resource Valuation

2.0.3.1 Field Water Quality

Data for dissolved oxygen, specific conductivity, and pH will be collected in the field using in-field probes (YSI water quality meters or similar). This is a snapshot approach; continuous monitoring of these parameters will not be conducted.

2.0.3.2 RBP

RPB data for each stream crossing will be collected using the same methodology stated in the Baseline Assessment Plan and scored to monitor restoration progress.

2.0.3.3 Benthic Macroinvertebrates

Benthic macroinvertebrate data for each stream crossing will be collected and scored to monitor restoration progress. Benthic collections will be streamflow dependent and will follow the same guidelines for collection as in the Baseline Assessment Plan.

2.0.3.4 HGM Assessment

HGM Assessments for each stream crossing will be collected using the same methodology stated in the Baseline Assessment Plan and scored to monitor restoration progress.

2.0.3.5 Visual Assessment Documentation

Photo documentation will occur during each sampling event. Specific photo locations are provided in **Table 2**. For resource crossings or temporary impacts, in addition to those listed in **Table 2**, the investigators should include various photographs of the restored wetland inside LOD as well as conditions outside the LOD (based on size, shape, and total area of the restored resource). Photographs will be geo-referenced with GPS coordinates.

Table 2. Stream Photo Location Requirements

Stream Type	Photographs
Virginia Streams	
Streams (Bankfull width <10')	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *RB C/L* – Standing on Right Bank looking down pipe centerline (C/L) • *LB C/L* – Standing on Left Bank looking down pipe C/L • *DS COND* – Downstream conditions outside LOD
Streams (Bankfull width >10')	• *RB DS VIEW* – Downstream View on Right Bank of impact area inside LOD • *LB DS VIEW* – Downstream View on Left Bank of impact area inside LOD • *RB US VIEW* – Upstream View on Right Bank of impact area inside LOD • *LB US VIEW* – Upstream View on Left Bank of impact area inside LOD • *RB C/L* – Standing on Right Bank looking down pipe C/L • *LB C/L* – Standing on Left Bank looking down pipe C/L • *DS COND* – Downstream conditions outside LOD
Streams (Within the LOD but not crossing pipe centerline)	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *DS COND* – Downstream conditions outside LOD

Stream Type	Photographs
Access Road Crossings	• *DS VIEW* – Downstream View of impact area inside LOD • *US VIEW* – Upstream View of impact area inside LOD • *C/L ACCESS-1* – Standing in Access Road looking towards impact • *C/L ACCESS-2* – Standing in Access Road looking towards impact • *DS COND* – Downstream conditions outside LOD
West Virginia Streams	
All Streams	• *US LOD US VIEW* – Upstream Edge of LOD Upstream View • *US LOD DS VIEW* – Upstream Edge of LOD Downstream View • *C LOD US VIEW* – Center of LOD Upstream View • *C LOD DS VIEW* – Center of LOD Downstream View • *DS LOD US VIEW* – Downstream Edge of LOD Upstream View • *DS LOD DS VIEW* – Downstream Edge of LOD Downstream View
Virginia and West Virginia Streams	
All Streams	• *CS LB UG 1* – Cross-section 1 Left Bank Upgradient View • *CS LB DG 1* – Cross-section 1 Left Bank Downgradient View • *CS RB UG 1* – Cross-section 1 Right Bank Downgradient View • *CS RB DG 1* – Cross-section 1 Right Bank Downgradient View • Additional cross-section photos will be collected as needed, to document each cross-section in the sampling reach, if applicable.

2.0.3.6 WV SWVM

The West Virginia SWVM forms will not be utilized during the monitoring period as the purpose of those forms is solely for determination of stream impact and voluntary compensatory mitigation for temporary impacts.

2.0.3.7 Unified Stream Methodology (USM)

No additional evaluations of streams are proposed using this methodology, as the purpose of the USM is solely for determination of stream impact and voluntary compensatory mitigation for temporary impacts.

3.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Field equipment will be inspected and calibrated each day prior to field crew deployment per the manufacturers' specifications. A field notebook will be maintained to document conditions encountered while samples are collected, including field observations, photographs taken, samples collected, and deviations from the sampling protocol. Appropriate field forms, as mentioned in previous sections, will be completed as required in the field and copied/filed upon return to the office. Manual data entry in spreadsheets and/or calculations performed will be subjected to a QA/QC review to ensure proper data transfer.

4.0 DATA ANALYSIS AND REPORTING PROCEDURES

Raw data in the form of field data forms from the stream surveys will be archived once relevant information has been transferred on to spreadsheets or other applicable programs. Wetland data sheets will be evaluated to determine the presence of hydric soils, hydrology, and vegetation. Wetland forms and photographs will then be filled out so that this information may be used in annual monitoring reports. Data will also be compared (annually) and evaluated to determine if performance standards are being met. To maintain clear communication with the agencies, Mountain Valley will submit annual monitoring reports to the applicable USACE district and relevant state agency, WVDEP or VADEQ, that address the previous year's monitoring activities. Each annual report will include:

- All data collected for each restored stream and wetland site in accordance with the Monitoring Plan;
- Any findings that warrant action under the Maintenance & Adaptive Management Plan and, if necessary, a corrective action plan based on those findings; and
- Recommended determination of whether each monitored site has achieved the applicable performance standards or if additional monitoring is warranted.

5.0 ADDITIONAL MONITORING OF STREAMS WITH ENDANGERED SPECIES

Under the Biological Opinion and Incidental Take Statement issued by the U.S. Fish and Wildlife Service (USFWS) on September 4, 2020, Mountain Valley is obligated to conduct continuous water-quality monitoring of suspended sediment concentrations (using turbidity as a surrogate) at various stream locations along the Project route that may host the endangered Roanoke logperch, endangered candy darter, and/or candy darter critical habitat. The Biological Opinion requires that corrective action measures be taken if sediment concentrations at the monitoring locations exceed prescribed thresholds.

The monitoring required by the Biological Opinion is principally designed to capture potential sediment inputs from upland construction activities. This is because FERC and USFWS determined that the potential for downstream sediment contributions from stream-crossing activities is minimal in magnitude and duration in comparison to the potential for sediment contributions from upland construction activities. That monitoring will continue until FERC and USFWS determine that sufficient vegetation has been re-established on upland areas of the ROW to prevent any likelihood of adverse turbidity or sedimentation effects on the species of concern.

Although not its principal focus, the water-quality monitoring conducted in accordance with the Biological Opinion will reflect the marginal sediment contributions of the Project's crossings of streams in the vicinity of federally listed species. That monitoring program and the corrective action protocols are, therefore, complementary of the monitoring proposed in this plan – and shall be submitted separately and in accordance with the applicable approvals.

6.0 REFERENCES

Cowardin, L. M., Carter, V., Golet, F. C. & LaRoe, E. T. 1979. Classification of wetlands and deepwater habitats of the United States. US Fish and Wildlife Service FWS/OBS 79/31.

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Appendix E:

MAINTENANCE & ADAPTIVE MANAGEMENT PLAN

Mountain Valley Pipeline Project

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APPENDIX E:

MAINTENANCE & ADAPTIVE MANAGEMENT PLAN

Mountain Valley Pipeline Project

INTRODUCTION

Mountain Valley's Adaptive Management Plan (AMP) anticipates likely challenges associated with resource restoration and provides a menu of actions available to address those challenges. During the three years of post-restoration monitoring, Mountain Valley shall also be conducting maintenance as required for all related erosion and sediment control and stormwater management permits issued for this project. All maintenance actions needed shall be implemented promptly - such as invasive species controls, reseeding/replanting, or soil modifications - subject to growing-season restrictions and as weather conditions allow. Therefore, due to this overlap of maintenance and AMP practice implementation time frames, Mountain Valley has combined these two requirements into this document.

The proposed restoration of the temporary impacts is the responsibility of Mountain Valley. Mountain Valley will maintain the restoration areas until full stabilization is documented. This includes routine inspection every four days in Virginia, every seven days in West Virginia, and after precipitation events that trigger inspection (as per Mountain Valley's stormwater construction permits for the Project), which is a requirement independent of the monitoring outlined in the Monitoring Plan.

The inspections conducted in accordance with the Monitoring Plan will provide the data needed to determine when maintenance and adaptive management actions are needed. If necessary and feasible, corrective actions and any associated supplemental monitoring may extend beyond the three-year post-construction monitoring period. Mountain Valley can address any such requirements since it has inspection, monitoring and maintenance requirements under its FERC approvals that continue through the operational life of this project. Consistent with sound adaptive management principles, the suggested response actions outlined in this AMP may be revised, omitted, supplemented, or substituted when warranted by the circumstances.

1.0 WETLAND ATTRIBUTES

1.0.1 Cowardin Classification

If the Cowardin Classification performance standards identified in Appendix C are not achieved, then the following management procedures may be implemented:

a. Check soil fertility, pH, organic matter percentage, and bulk density, and
b. Correct any issues found in (a) and then seed and/or replant at the appropriate time of year; or
c. If no issues are found in (a), then seed and/or replant at the appropriate time of year.
d. If the vegetation performance standards fail to be met after three annual attempts, then, subject to approval of the appropriate permitting agencies (United States Environmental Protection Agency, West Virginia Department of Environmental Protection, and/or Virginia Department of Environmental Quality) for said impact area(s), Mountain Valley may purchase mitigation credits or make appropriate in-lieu fee (ILF) contributions, using the assumption that such area was permanently impacted without taking credit for partially successful restoration. Mountain Valley will work with the agencies to appropriately stabilize the area (if necessary) prior to or concurrently with proposing to purchase mitigation credits or make an ILF contribution.

1.0.2 Area

If the wetland-area performance standard identified in Appendix C is not met, then Mountain Valley will evaluate whether the area required to be a wetland is smaller than baseline due to incorrect grading or disposal of extra subsoil (displaced by the pipe installation) in the wetland area. If incorrect grading or disposal of extra subsoil is determined to be the cause, then, subject to approval of the appropriate permitting agencies, Mountain Valley will regrade and reseed/replant, purchase mitigation credits, and/or make appropriate ILF contributions, using the assumption such an area was permanently impacted without taking credit for partially successful restoration. The preferred response will be to regrade and reseed/replant the wetland. However, providing additional mitigation credits may be the appropriate response in certain conditions, that may include, for example, when previous attempts to regrade or reseed/replant were unsuccessful or when accessing the location with heavy grading equipment would likely result in more harm than potential beneficial.

1.0.3 Topographical Survey

If the requirement for the wetland area elevations to be restored as close as practicable to the pre-construction contours is not met, then the Mountain Valley will evaluate whether the topographical differences relative to baseline is due to incorrect grading or disposal of extra subsoil (displaced by the pipe installation) in the wetlands area. If that is the case, the area shall be regraded and reseeded/replanted subject to approval of the appropriate permitting agencies.

If the contour standard is still not achieved after regrading, then, subject to approval of the appropriate permitting agencies for said impact area(s), Mountain Valley may purchase mitigation credits or make appropriate ILF, using the assumption that such area was permanently impacted.

1.0.4 Dominant Vegetation

If the performance standard identified in Appendix C for dominant vegetation is not met, the management procedures outlined in Section 1.0.1 above will be implemented.

1.0.5 Invasive-Species Cover

If the performance standard for invasive-species cover identified in Appendix C is not satisfied, then invasive plant species shall be removed mechanically (i.e., hand weeding), or with herbicide applications if approved by all applicable regulatory agencies.

If requested by Mountain Valley, this performance metric may be re-evaluated by the permitting agencies for situations where adjacent land cover contains invasive species or factors outside of the control of Mountain Valley prevent this performance standard from being met. Mountain Valley may also request that the permitting agencies re-evaluate this performance metric to consider the ecological tradeoffs of controlling invasive cover to the potential benefit of species richness or other ecologically based measures that identify the benefits of not re-disturbing the area.

If the invasive-species-cover performance standard, as modified, is not met after three seasonal attempts, then, subject to approval of the appropriate permitting agencies for the impact area(s), Mountain Valley may purchase mitigation credits or make appropriate ILF contributions, using the assumption that such area was permanently impacted.

1.0.6 Native (Non-Invasive) Herbaceous Vegetation Coverage

If the performance standard for native (non-invasive) herbaceous vegetation coverage identified in Appendix C is not met, the management procedures outlined in Section 1.0.1 above will be implemented.

1.0.7 Hydric Soils

If the performance standard for hydric soils identified in Appendix C is not met by the end of the three-year monitoring period, then the hydrology and appropriate response actions will be evaluated as outlined in Section 1.0.8. If efforts to restore hydric soils are not successful, subject to approval of the appropriate permitting agencies for the impact area(s), Mountain Valley will purchase mitigation credits or make appropriate ILF contributions, using the assumption that such area was permanently impacted.

1.0.8 Hydrology Indicators

If the performance standard for hydrology indicators identified in Appendix C is not met, the first step will be to check the Palmer Drought Severity Index and the US Drought Monitor for the subject location to determine if the area is in a moderated drought (Palmer Index) or abnormally dry or drier (U.S. Drought Monitor) conditions. If there are such dry conditions, hydrology indicators of a wetlands are not likely to be present, at least for "drier end" wetlands areas, and no actions are necessary.

If such conditions do not exist and wetland hydrology indicators are not identified after three annual seasonal attempts, then shallow ground water wells may be installed (U.S. Army Corps of Engineers, 2005) to determine if wetlands hydrology is present but not identifiable in the soil media due to the time lag of some soil chemistry parameters. Mountain Valley may also consider regrading or directing overland flow in the wetland area to improve hydrological conditions. This determination will be made prior to the installation of ground water wells and completed by a wetland professional.

If the hydrology performance standard is not met during a normal, or drier-than-normal, growing season at least once during the three-year monitoring period, then Mountain Valley will evaluate whether additional monitoring is likely to demonstrate that the performance standard has been met. If efforts to restore hydrology indicators are not successful, subject to approval of the appropriate permitting agencies for said impact area(s), Mountain Valley will purchase mitigation credits or make appropriate ILF contributions, using the assumption that such area was permanently impacted.

1.0.9 Bulk Density

If it is determined that soil density may be restricting root-growth conditions, and if standard decompaction practices (disking, plowing, cultivating, tilling, or incorporation of organic matter into the topsoil horizon) have not sufficiently de-compacted the soil, then bulk density testing may be completed for the topsoil (upper 6 to 12 inches depending on soil profile). The upper 12 inches of the soil profile shall have a bulk density of less than the following levels so that root growth is not restricted, dependent on soil texture:

Clayey: 91.7 lbs/cf or 1.47 g/cm3
Silty: 103.0 lbs/cf or 1.65 g/cm3
Sandy: 112.3 lbs/cf or 1.80 g/cm3

The bulk density for textures in between these classes shall be linearly interpolated based on the in situ soil texture percentages of these three soil particle size classes.

The area may then be further de-compacted to meet these standards or coordination with the agencies will be conducted to determine if mitigation banking or ILF contributions would be more appropriate, depending on site access and location.

2.0 STREAM ATTRIBUTES

The main areas of maintenance and adaptive management concern or focus are as follows:

- Maintaining appropriate geomorphology, i.e., monitored stream dimension (cross section), bed material, and photo documentation.
- Maintaining a stable channel.
- Minimizing bank erosion.
- Maintaining appropriate bedforms and particulates.
- Establishing early riparian vegetation.
- Controlling invasive species.

The physical features of any natural channel, as well as restored channels, change periodically, and such changes do not always require maintenance. However, when these changes adversely affect the stability, structural integrity, and/or habitat quality within the channels, actions should be taken. Stream attributes may be assessed using visual inspections (observations), longitudinal profiles, cross-section surveys, and pebble counts.

Note, as discussed, not all changes are considered detrimental (such changes occur in natural stream channels as well). For example, considerable reconfiguration of physical features may be allowed as long as they do not adversely affect conveyance, bank stability, structural integrity or habitat quality.

<u>Channel Stability</u>:

The longitudinal profiles and steam cross-sections will be compared with previous surveys and assessed to determine changes or make recommendations, as necessary, regarding the configuration of the re-established channel. The key areas of concern are erosion of stream banks, aggradation of channel that could impair flood capacity or change channel stability, and aggradation of the overbank channel or damage to the floodplain. The process for addressing erosion problems will be highly proactive with annual surveys, as well as ongoing monitoring as per the Project's Erosion and Sediment Control Plans in West Virginia and *Annual Standards and Specifications* in Virginia. This will allow Mountain Valley to identify potential problems early so that low-tech vegetative methods can be employed to slow down erosion. If the problems become severe enough to warrant structural treatment, then a design process will be initiated (after contacting the appropriate resource agencies).

The proposed restoration measures should be self-maintaining after an initial vegetation establishment period and should require little, if any, maintenance. However, additional action may need to be taken if the flood capacity of the channel is reduced (some type of infringement on the channel or in the floodplain) or if the geomorphic stability of the restored channel is compromised. These problems could occur due to excess sediment deposition, erosion, topographic changes, higher-than-expected channel roughness, or differences in the predicted channel dimensions and associated flow regime versus pre-construction data.

Mountain Valley will undertake an evaluation of options in the unlikely event of such a channel failure or compromise. Changes that may be necessary if such events were to occur may include, but are not limited to, the following:

- Removal of vegetation.
- Modification of channel dimensions.
- Addition of more structure.
- Regrading of vegetative areas.

If appropriate, Mountain Valley may choose to utilize a "wait and see" approach. Other measures may be undertaken if anticipated ecological benefits do not come to fruition, including increases or decreases in vegetative plantings, modification of instream habitat, or introduction of large woody debris.

Riffle and Pool Features:

After stream restoration, should the riffle and pool depth/dimensions become unstable or depart from the baseline and performance parameters, adaptive management may become necessary. In watersheds with elevated sediment loads unrelated to the Project, pool features may require structures to maintain appropriate or acceptable dimensions. Similarly, constructed riffle may also be utilized to provide additional sediment transport, benthic macroinvertebrate habitat enhancement, and pool maintenance. Monitoring pool features (using the survey data) will be critical to determining the effectiveness of the restoration efforts and if adaptive management in the riffle and pool features will be necessary.

2.0.1 Stream Survey

The data being collected with detailed stream surveys are to be analyzed utilizing the following six metrics and compared to their specific performance standards:

a. Stream Cross Section Area
b. Pool-to-Pool Spacing
c. Maximum Pool Depth
d. Average Riffle Slope
e. Average Reach Slope
f. Pebble Counts

If the performance-standard specifications are not met for the above metrics and have not been waived via a "dynamic stability" determination, the following Maintenance and Adaptive Management Actions may be implemented:

1. If monitoring indicates that performance-standard issues are caused by erosion in adjacent right-of-way (ROW), correct the erosion and sediment control issue and remove sediment.
2. If the issues are being caused by offsite watershed changes, Mountain Valley may propose a site-specific stabilization plan to the applicable agencies and, if approved, implement promptly.
3. Alternatively, subject to approval of the appropriate permitting agencies for the impact area(s), Mountain Valley may purchase mitigation credits or make

appropriate ILF contributions, using the assumption that such area was permanently impacted.

2.0.2 Stream Bank Stabilization

a. Riparian Buffer

If the performance standards do not match those outlined in Appendix C then following adaptive strategies may be completed:

1. Check soil fertility, pH, organic matter percentage, and/or bulk density, and
2. Correct any issues found in (a) and then seed and/or replant at the appropriate time of year; or
3. If no issues are found in (a), then seed and/or replant at the appropriate time of year.
4. If the vegetation performance standards fail to be met after three annual attempts, then Mountain Valley will coordinate with the agencies to determine if the riparian area is detrimental to the resource restoration and if additional mitigation credits or appropriate ILF contributions are required.

b. Invasive Species Cover

1. If the performance standards identified in Appendix C for invasive-species cover are not satisfied, then invasive species shall be removed mechanically (i.e., hand weeding) or with herbicide applications if approved by all applicable regulatory agencies.
2. If requested by Mountain Valley, this performance metric may be re-evaluated by the permitting agencies for situations where adjacent land cover contains invasive species or factors outside of the control of Mountain Valley prevent this performance standard from being met. Mountain Valley may also request that the permitting agencies re-evaluate this performance metric to consider the ecological tradeoffs of controlling invasive cover to the potential benefit of species richness or other ecologically based measures that identify the benefits of not re-disturbing the area.
3. If the invasive-species cover performance standard, as modified, is not met after three annual seasonal attempts, then, subject to approval of the appropriate permitting agencies for the impact area(s), Mountain Valley may purchase mitigation credits or make appropriate ILF contributions.

2.0.3 Stream Resource Valuation

Sections 2.04 – 2.07 in Appendix C identify performance standards for the following parameters:

- Field Water Quality (dissolved oxygen, specific conductivity, pH)
- Rapid Bioassessment Protocol (RBP)
- Benthic Macroinvertebrates
- HGM Assessment

If monitoring shows a deviation from the performance standards for any of these parameters, Mountain Valley will consult with the permitting agencies regarding the probable cause of the deviations, if any. Causes not related to the Project may include but are not limited to: watershed land use changes, time of year, and precipitation amounts and patterns. Adaptive management actions may include (a) additional monitoring (to see if the changes are just temporal or caused by upstream conditions), (b) additional plantings, (c) adding woody debris, (d) implementing stream structural changes, (e) translocating benthic macroinvertebrates with HabiTubes, and/or (f) the purchase of additional credits or ILF contributions.

2.0.4 Visual Assessment Documentation

These photographs shall be utilized by Mountain Valley, its contractor(s), and the agencies to assist in visualization of the ultimate restoration goal – to match baseline conditions.

2.0.5 West Virginia Stream and Wetland Valuation Metric (WV SWVM)

As appropriate, Mountain Valley and the applicable agencies may use the data summarized in the baseline WV SWVM assessment in the AMP decision-making process.

2.0.6 Unified Stream Methodology (USM)

As appropriate, Mountain Valley and the applicable agencies may use the data summarized in the baseline USM assessment in the AMP decision-making process.

3.0 SITE PROTECTION AND LONG-TERM MANAGEMENT

The restoration areas are located within the Project's ROW and construction access areas where future disturbance will be limited. Per FERC requirements, Mountain Valley is responsible for inspecting and maintaining the ROW for the operational life of the Project. Upon the completion of requirements found in the stormwater construction permit (WV) or Stormwater Management Plan (VA) and pursuant to authorizations issued under Section 10 of the Rivers and Harbors Act and Section 404 and 401 of the Clean Water Act, monitoring the restoration areas will fall under the monitoring program Mountain Valley utilizes for utility ROWs as required by its FERC certification.

Furthermore, the restored stream channels are considered waters of the U.S. and will, therefore, be protected from future disturbances in the form of pollutant discharges, channel alterations, or filling by existing laws and regulations limiting such impacts.

4.0 REFERENCES

Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (2008). Corps of Engineers 33 CFR Parts 325 and 332 Environmental Protection Agency 40 CFR Part 230, Federal Register Vol. 73, No. 70, Thursday, April 10, 2008, pp 19594-19705.

National Drought Mitigation Center, University of Nebraska-Lincoln. U.S. Drought Monitor. Available at: https://droughtmonitor.unl.edu/

National Oceanographic and Atmospheric Administration. Palmer Drought Index. Available at: https://www.ncdc.noaa.gov/temp-and-precip/drought/weekly-palmers/

U.S. Army Corps of Engineers, 2005. Technical Standard for Water-Table Monitoring of Potential Wetland Sites; publication ERDC TN-WRAP-05-2. Available at: https://www.nrc.gov/docs/ML1327/ML13276A040.pdf

Appendix F:

SUPPLEMENTAL CREDIT DETERMINATION METHODOLOGY

Mountain Valley Pipeline Project

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EXHIBITS

SUPPLEMENTAL CREDIT DETERMINATION METHODOLOGY

Mountain Valley Pipeline Project

1.0 INTRODUCTION

Mountain Valley Pipeline, LLC (Mountain Valley) has contracted Potesta & Associates, Inc. (POTESTA), Tetra Tech, Inc. (Tetra Tech), and Wetland Studies and Solutions, Inc. (Project Team) to develop a to discuss mitigation for impacts to aquatic resources associated with the West Virginia and Virginia portions of the. The purpose of this document is to provide a clear understanding on how aquatic resource temporary impacts mitigation in West Virginia and Virginia are being determined for the Mountain Valley Pipeline (Pipeline) project (the Project). This Supplemental Credit Determination Methodology document (CDMD) is a companion to the *Comprehensive Stream and Wetland Monitoring, Restoration, and Mitigation Framework* (Framework Document) which contains a compendium of the discussion contained herein. The methods utilized for credit determination of permanent impacts follow applicable regulations in Virginia and West Virginia; however, voluntary additional mitigation being provided by Mountain Valley for temporal loss during temporary impacts has been developed specifically for this project.

Under Section 404 of the Clean Water Act, an applicant for a Department of the Army Permit must comply with provisions found in Section 404(b)(1) as well as other applicable regulations and statutes. Section 404(b)(1) guidelines require that applicants mitigate by avoiding and minimizing potential impacts to aquatic resources to the maximum extent practicable. In addition to Section 404(b)(1) guidelines, projects authorized by the United States Army Corps of Engineers (USACE) should be consistent with the mitigation rules found in 33 CFR Part 332 Compensatory Mitigation for Losses of Aquatic Resources (Mitigation Rule) (33 U.S.C. 401 et seq.: 33 U.S.C. 1344; and Pub. L. 108-136). The proposed approach to compensatory mitigation for unavoidable impacts outlined in this document has been developed to meet or exceed the above-mentioned regulations and guidance.

2.0 COMPENSATORY MITIGATION CREDIT REQUIREMENTS

In addition to complying with federal regulations, projects must comply with regulations that are often state specific. In Virginia, in the USACE Norfolk District, mitigation may take the form of options listed in 9 VAC 25-210-116 (C)(2)-(C)(3). This includes the use of mitigation banking (banking), in-lieu fee programs (ILF), and permittee-responsible mitigation. Mitigation amounts are determined using the Unified Stream Methodology (USM) (Streams) and compensation ratios (Wetlands). Applicants in West Virginia utilize a different methodology that was developed for both stream and wetland impacts in the West Virginia portions of the Huntington and Pittsburgh Districts.

2.1 Virginia Methodology

The USM was developed by the USACE and the Virginia Department of Environmental Quality (VADEQ) to rapidly assess stream compensation requirements for permitted streams. The USM process assigns a Reach Condition Index to a stream reach, assesses the type or severity of impact and then can assist in determining the compensation that may be required. This method is used by both the USACE for Department of the Army authorizations and by the VADEQ's Virginia Water Protection Permit Program. It may be applied to projects where compensation is performed on-site, off-site, banking, and ILF.

VADEQ has established "standard mitigation ratios" by regulation (9 VAC 210-80(C)). These ratios are generally recognized by the Norfolk District. The standard mitigation ratios are as follows:

* 2:1 (2 acres compensation for each 1 acre of impact) for forested wetland impacts.
* 1.5:1 for scrub-shrub wetland impacts.
* 1:1 for emergent wetland impacts.
* 1:1 for conversion impacts (ex. forested wetland converted to emergent wetland).
* Project-specific ratios for other surface water impacts.

Alternative ratios may be used for individual permits.

2.2 West Virginia Methodology

In an effort to quantify a project's effects to aquatic resources, the USACE has developed a system to quantify existing and future conditions. The approach is often referred to as the USACE's West Virginia Stream and Wetland Valuation Metric (WVSWVM) (USACE 2011) and its purpose is to provide a suitable metric to assess and to correlate baseline conditions of proposed impacts and of compensatory mitigation. The WVSWVM utilizes existing conditions of a proposed impact reach to determine a "debit" or impact unit yield. The WVSWVM can also be used to determine a "credit" or mitigation unit yield.

The WVSWVM incorporates the "Hydrogeomorphic Approach" for developing functional indices and the protocols used to apply these indices to the assessment of ecosystem functions at a site-specific scale. This approach generates a functional capacity index for hydrology, biogeochemical cycling, and habitat functions. The worksheet utilizes the United States Environmental Protection Agency's Rapid Bioassessment Protocol (Barbour et al., 1999) physical habitat forms, the USACE's *Operational Draft Regional Guidebook for the Functional Assessment of High-gradient Headwater Streams and Low-Gradient Perennial Streams in Appalachia* (Summers, et al, 2017), the West Virginia Department of Environmental Protection's West Virginia Stream Condition Index (Gerritsen, et al., 2000) and water quality data to interpret the physical, chemical, and biological integrity of "waters of the United States" and generate an index score. Wetland evaluations require data on the wetland acreage and wetland Cowardin (1979) type designation.

3.0 MITIGATION FOR PERMANENT IMPACTS

Mountain Valley has provided mitigation for permanent impacts using banking and ILF programs in both Virginia and West Virginia. A list of the permanently-impacted streams and wetlands and their associated mitigation may be found in **Tables 17 and 18 of the IP Application**. Mitigation purchases are listed in **Tables 1, 2,** and **3**. A discussion of each of these banks or ILF programs is provided in **Exhibit A**. Mountain Valley has provided compensatory mitigation for all proposed permanent impacts in quantities that meet or exceed the applicable regulatory requirements. Accordingly, no additional compensatory mitigation is proposed in this CDMD for permanent impacts.

3.1 Permanent Stream Impacts Associated with Access Roads

All of the proposed permanent stream impacts result from the installation, repair, or replacement of culverts associated with access roads. Properly-sized and countersunk culverts are necessary to maintain natural stream flow across access roads. Nevertheless, they are considered permanent impacts. The compensatory mitigation provided for these impacts is summarized in the following table.

Table 1
Banking Credits Previously Purchased for Permanent Stream Impacts

<table>
<tr><th></th><th>Impacts (ft)</th><th>Credits Required</th><th>Credits Purchased</th></tr>
<tr><th colspan="4">Foster Run Mitigation Bank</th></tr>
<tr><td>Primary</td><td>330</td><td>186</td><td>362</td></tr>
<tr><th colspan="4">Hayes Run Mitigation Bank</th></tr>
<tr><td>Primary</td><td>326</td><td>218</td><td>356</td></tr>
<tr><th colspan="4">Kincheloe Mitigation Bank</th></tr>
<tr><td>Primary</td><td>192</td><td>108</td><td>283</td></tr>
<tr><th colspan="4">Spanishburg Stream and Wetland Mitigation Bank</th></tr>
<tr><td>Primary</td><td>135</td><td>77</td><td rowspan="2">675</td></tr>
<tr><td>Secondary</td><td>293</td><td>170</td></tr>
<tr><th colspan="4">Thompson Place Farm, LLC</th></tr>
<tr><td>Secondary</td><td>63</td><td>60</td><td>60</td></tr>
<tr><td>Total</td><td>1,339</td><td>819</td><td>1,736</td></tr>
</table>

*Additional credits were also purchased from Graham and David Mitigation Bank, LLC

3.2 Permanent Wetland Conversion Impacts

Approximately 90% of proposed permanent wetland impacts for the Project result from the conversion of Palustrine Forested (PFO) or Palustrine Scrub-Shrub (PSS) wetlands to Palustrine

Emergent (PEM). Mountain Valley's ability to restore PFO and PSS wetlands to their preconstruction condition is limited by the need to maintain vegetation on the right-of-way (ROW) to allow inspections of the pipeline and to protect the pipe coating from damage by woody vegetation roots. Although vegetation maintenance will be limited to the extent necessary in wetlands, Mountain Valley has erred on the side of caution by deeming all conversion impacts to be permanent for the purpose of calculating compensatory mitigation. Nevertheless, conversion impacts will be restored to PEM wetlands so that there is no loss in wetland area resulting from these impacts. Additionally, most of the "permanent" conversion impacts are not expected to be permanent in fact. Except for actively-maintained areas of the ROW, Mountain Valley will plant bare root saplings in the temporary ROW associated PFO wetlands, allowing these systems to return to PFO conditions. The compensatory mitigation provided for wetland conversion impacts is summarized in the following table.

Table 2
Banking Credits Previously Purchased for Wetland Conversion Impacts

	Impacts (acres)	Credits Required	Credits Purchased
Beverly Mitigation Bank Site			
Secondary	0.4420	0.4420	1.3775
Kincheloe Mitigation Bank			
Primary	0.1554	0.1554	0.997
Secondary	0.1049	0.1049	
Spanishburg Stream and Wetland Mitigation Bank			
Primary	0.2020	0.2020	2.839
Secondary	0.8460	0.8460	
Banister Bend Mitigation Bank			
Primary	0.9269	0.9269	7.1
Secondary	0.3337	0.3337	
Virginia Aquatic Resource Trust Fund			
Primary	0.0852	0.0852	0.0852
Total	**3.0961**	**3.0961**	**12.3787**

3.3 Permanent Wetland Fill Impacts

Approximately 10% of the total permanent wetland impacts for the Project result from the placement of fill. Those unavoidable impacts are associated with the construction of permanent access roads or other permanent above-ground facilities. The compensatory mitigation provided for permanent wetland fill impacts is summarized in the following table.

Table 3
Banking Credits Previously Purchased for Permanent Wetland Impacts

	Impacts (acres)	Credits	Purchased
Beverly Mitigation Bank Site			
Secondary	0.1307	0.1307	1.3775
Kincheloe Mitigation Bank			
Primary	0.0115	0.0115	0.9770
Secondary	0.1078	0.1078	
Spanishburg Stream and Wetland Mitigation Bank			
Primary	0.0228	0.0228	2.839
Secondary	0.1730	0.1730	
Banister Bend Mitigation Bank			
Secondary	0.0539	0.0539	7.1
Total	**0.4997**	**0.4997**	**12.3787**

4.0 SUPPLEMENTAL MITIGATION FOR TEMPORARY IMPACTS

Temporary impacts occur when fill is placed in "Waters of the United States" that are then restored to similar preconstruction contours when construction is complete. These impacts do not result in changes in the bottom elevation of streams and wetlands; thus, are not considered a loss of aquatic resources. Therefore, compensatory mitigation for temporary impacts is typically provided by the restoration of the resources.

To account of the temporary loss of use, Mountain Valley proposes to voluntarily mitigate for temporal impacts associated with stream and wetland crossings. This section discusses the methodology for calculating the quantity of supplemental compensatory mitigation credit to be provided to compensate for temporal mitigation.

4.1 Temporal Mitigation Credit Determination Methodology

Compensatory mitigation for temporal impacts is not typically provided for actions regulated by the respective Corps districts, West Virginia Department of Environmental Protection (WVDEP), or VADEQ. Mountain Valley reviewed authorities from the relevant agencies, as well as approaches to temporal loss mitigation in other districts, to develop a consistent approach across all three Corps districts.

The WVSWVM credit determination approach developed by the West Virginia Interagency Review Team [IRT] (which includes the Huntington and Pittsburgh Districts, WVDEP, USEPA, and other agencies) includes credit debit modifiers for temporary impacts during construction of 3% per year and for a period of post-restoration lag in vegetative maturity that ranges from 0 - 2% per year. Consistent with the WVSWVM approach, the WVDEP has promulgated a regulation endorsing mitigation for temporal loss at a rate of 3% per year for the duration of the impact (W. Va. Code R. § 47-5A-6.2.b). Neither the Norfolk District nor VADEQ have adopted a standard approach to mitigating temporal loss.

To be consistent across all three districts, Mountain Valley proposes to provide supplemental compensatory mitigation for temporal loss at a standard rate of 3% per year for all temporary impacts. The same rate (3%) will be applied both to the duration of the construction impact and an assumed period of post-construction restoration. This approach is more conservative than the WVSWVM approach, which would assign a 0% credit debit for temporal loss for impacts that (1) last less than one year and (2) will reach maturity within 5 years of post-impact restoration.

Mountain Valley has calculated the amount of supplemental compensatory mitigation to be provided using WVSWVM forms in West Virginia, with the modified 3% per year debit assumptions noted above. In Virginia, supplemental compensatory mitigation has been calculated by applying a 3% credit per year credit debit to the mitigation requirement that would be generated for a hypothetical permanent impact using the USM (streams) or wetland area (i.e., Supplemental compensatory mitigation in Virginia = impact duration x 3% per year x hypothetical mitigation requirement for a permanent impact).

4.2 Temporary Impacts Associated with Pipeline Crossings

Streams and wetlands will be temporarily impacted by preparation of the ROW and excavation of the trench to all the installation of the pipeline. Once an aquatic resource crossing is commenced, it is completed as expeditiously as possible to minimize the duration of instream work. The impact location is restored immediately upon completion of the pipeline installation activity.

For temporarily-impacted streams, the preexisting substrate and contours will be restored and stream flow (if flowing water present) will be returned. Elevated sediment and turbidity levels are expected to dissipate within several days. To conservatively compensate for any lingering temporal loss following restoration of the stream crossing, Mountain Valley will include one year of compensatory mitigation from the date the stream is impacted, which will also include the de minimis duration of the instream work. For temporarily-impacted wetlands, the preexisting contours will be restored with the segregated wetland topsoil (except in rare situations in which saturated or flooded conditions prevent topsoil segregation). Through a combination of the natural seedbank, seeding, and, where required, bare root sapling or shrub plantings, PEM wetland vegetation is expected to return within one full growing season. No additional compensatory mitigation is proposed for restoration of PSS or PFO vegetation because, as discussed in Section 3.2, compensatory mitigation has already been provided for those conversion impacts. To conservatively compensate for any lingering temporal loss following restoration of the wetland crossing, an additional two years of compensatory mitigation will be provided.

In summary, for the purpose of calculating the supplemental compensatory mitigation proposed for each impact described above, the duration of temporal loss is assumed to be the post-restoration period of one or two years for streams and wetlands (respectively), which also includes the estimated de minimis duration to complete the crossing. The duration of temporal loss will be mitigated at a rate of 3% per year.

4.3 Temporary Impacts Associated with the Placement of Temporary Fill

Temporary fills may be placed in aquatic resources in several circumstances. The most common type of temporary fill is timber mat crossings. Timber mats that are used at stream crossings are often included because they are located below the ordinary high water mark and do not change or alter the stream bottom. Timber mats are used in wetlands, as required by Federal Energy Regulatory Commission and recommended by other resource agencies, to reduce potential impacts to these resources from equipment passage. Timber mats may remain in place for an extended duration during the construction phase of the Project because they are necessary to maintain access to parts of the ROW for the purposes of construction, inspection, and maintenance of the Project's erosion and sediment controls. Other temporary fills may be necessary to construct and maintain temporary access roads and workspaces. When no longer needed for construction of the Project, temporary fills will be removed, and the affected resources will be restored to preconstruction conditions.

To calculate the supplemental compensatory mitigation to be provided for temporary fill impacts, Mountain Valley has first calculated the anticipated duration of the fill. For temporary fills that are currently in place (such as existing timber mat bridges), the duration of the assumed construction impact will run from date the fill was first placed until the anticipated date it will be removed. For temporary fills that have not yet occurred, Mountain Valley has estimated the expected duration the temporary fill will remain in place. Although resources with temporary fills are expected to be restored quickly, Mountain Valley has applied the same assumed post-restoration period of temporal loss as for crossings. That is, an additional one year of compensatory mitigation will be provided for streams and two years for wetlands.

In summary, for the purpose of calculating the supplemental compensatory mitigation proposed for each impact described above, the duration of temporal loss is assumed to be the duration of the temporary fill placement and the post-restoration period of one or two years for streams and wetlands (respectively). The duration of temporal loss will be mitigated at a rate of 3% per year. To be conservative, for the purpose of calculating additional temporal mitigation Mountain Valley will assume a 6 year time period for the temporary fills that have been installed in wetlands and 5 year time period for temporary fills that have been installed in streams.

4.4 Proposed Supplemental Compensatory Mitigation

Applying the methodology described above, Mountain Valley will calculate an additional compensatory mitigation commitment to be provided for *each* temporary impact in the IP application. Mountain Valley intends to provide this supplemental compensatory mitigation though the following order of preference: (1) using previously purchased (but unused) credits from mitigation banks; (2) purchasing mitigation bank credits; and (3) making contributions to ILF programs. The data presently being collected for the Baseline Assessment will be used to value the temporary impacts and calculate compensatory mitigation. Tables identifying the proposed supplemental mitigation for each impact will be provided to the Corps, WVDEP, and VADEQ concurrently with the submission of the Baseline Assessment data.

Mountain Valley recognizes that the supplemental compensatory mitigation methodology relies on certain forward-looking assumptions, including the timely success of restoration activities. If the assumptions underlying this CDMD prove incorrect and the mitigation provided for temporal loss is inadequate as a result, Mountain Valley will address any additional compensatory mitigation needs in the conjunction with its implementation of Maintenance and Adaptive Management Plan.

Exhibit B contains a summary of the proposed temporal mitigation requirements for streams and wetlands.

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EXHIBIT A

SITE SELECTION

EXHIBIT A – SITE SELECTION

1.0 MITIGATION BANK CREDITS AND IN-LIEU-FEE FUND CONTRIBUTIONS

Mountain Valley has purchased credits from several different banks and contributed to one In-Lieu-Fee Fund (ILF). The following sections provide additional information on the mitigation banks that have supplied credits for permanent and conversion impacts associated with the Project, and/or are expected to be utilized for temporal losses associated with temporary impacts.

1.1 Kincheloe Mitigation Bank

The Kincheloe Mitigation Bank (Kincheloe Bank) (LRP-2014-1128) includes a total of 632 acres located approximately 3 miles west of Kincheloe in Harrison and Lewis Counties, West Virginia in the West Fork River 8-digit Hydrologic Unit Codes (HUC) (05020002). The Kincheloe Bank operates under WV Bunrootis LLC's umbrella banking instrument and provides both wetland and stream credits. The bank's umbrella instrument was approved by West Virginia's Interagency Review Team (IRT) in August 2012. The primary service area for the bank is the West Fork River watershed with the secondary service area covering the Monongahela (05020003), Middle Ohio North (05030201), Little Kanawha (05030203), and Tygart Valley (05020001) 8-digit HUCs. The Kincheloe Bank began releasing credits in 2015 and has provided mitigation for both private and State funded projects. To date, at least six credit releases have occurred. Mountain Valley utilized the Kincheloe bank to offset permanent stream and wetland impacts in the West Fork watershed and for permanent wetland impacts in the Middle Ohio North. The use of secondary credits has been approved by the IRT. Credits at this bank have been generated using the WVSWVM.

1.2 Foster Run Mitigation Bank

The Foster Run Mitigation Bank (Foster Run Bank) (LRH-2009-150-LKR) is located in Tyler County, West Virginia. The bank is sponsored by Resource Environmental Solutions, LLC (RES) and operates under RES' umbrella instrument. The RES umbrella agreement was originally held by EarthMark, approved by the IRT in 2008 (the first in West Virginia). The Foster Run Bank provides both stream and wetland credits. Its primary service area is Middle Ohio North 8-digit HUC with an approved secondary service area that includes Monongahela, West Fork, Little Kanawha, Upper Ohio North (5030101), and Upper Ohio South (05030106) 8-digit HUCs. The Foster Run Bank began releasing credits in 2017 and has provided mitigation for both private and State funded projects. Foster Run provided credits for permanently-impacted streams in the Middle Ohio North 8-digit HUC.

1.3 Hayes Run Mitigation Bank

The Hayes Run Mitigation Bank (Hayes Run Bank) (LRH-2009-150-LKR) is located in Roane County, West Virginia east of Roxalana. The Hayes Run Bank operates under WV Bunrootis LLC's umbrella banking instrument and provides both wetland and stream credits. Its primary service area is the Little Kanawha. The IRT-approved secondary service areas include Middle Ohio South (05030202), Middle Ohio North, Upper Ohio North, and Upper Ohio South 8-digit HUCs. The Hayes Run Bank began releasing credits in 2013 and has provided mitigation for both private and State funded projects. Hayes Run provided credits for permanently-impacted streams in the Little Kanawha 8-digit HUC. Credits at this bank have been generated using the WVSWVM.

1.4 Beverly Mitigation Bank Site

The Beverly Mitigation Bank Site (Beverly Bank) (LRH-2013-574-OHR) is located in Randolph County, West Virginia near the town of Beverly. The Beverly Bank operates under Green Rivers LLC's umbrella instrument and provides both wetland and stream credits. The primary service area for the bank is the Tygart Valley with the IRT-approved secondary service area covering the Monongahela, West Fork, Little Kanawha, Elk (05050007) and Cheat (05020004) 8-digit HUCs. The Beverly Bank was established in 2015 and began releasing credits in 2016. The Beverly Bank provided credits for permanent wetland impacts in the Elk 8-digit HUC utilizing the WVSWVM.

1.5 Spanishburg Stream and Wetland Mitigation Bank

The Spanishburg Stream and Wetland Mitigation Bank (Spanishburg Bank) (LRH-2010-00116-NEW) is located on a 64-acre parcel in Mercer County, West Virginia approximately 3 miles west of Spanishburg. The Spanishburg Bank operates under WV Bunrootis LLC's umbrella banking instrument and provides both wetland and stream credits. The primary service area for the Spanishburg Bank is the Upper New (05050002) 8-digit HUC. The IRT-approved secondary service area includes the Greenbrier (05050003), Lower New (05050004), Gauley (05050005), Elk, Coal (05050009), Upper Kanawha (05050006), and Lower Kanawha (05050008) 8-digit HUCs. The first credits were sold in 2014. The Spanishburg Bank provided credits for permanent stream and wetland impacts in the Upper New 8-digit HUCs. The IRT also approved the use of the Spanishburg Bank for stream credits for permanent impacts in the Elk, Gauley, Greenbrier, and Lower New 8-digit HUCs and wetland credits were approved for purchase in the Gauley and Greenbrier 8-digit HUCs.

1.6 Thompson Place Farm, LLC

The Thompson Place Farm, LLC is located in Montgomery County, Virginia. The Thompson Place Farm operates under the Thompson Place Farm, LLC banking instrument which was approved by Virginia's IRT in 2020. The service area for the Thompson Place Farm bank includes the Upper New River (05050001) 8-digit HUC and the adjacent 8-digit HUC Middle New River (05050002). Stream credits from this bank were developed using the Unified Stream Methodology (USACE and VADEQ, 2007). Mountain Valley utilized credits from the Thompson Place Farm Bank to offset permanent stream impacts in the Middle New 8-digit HUC.

1.7 Banister Bend Mitigation Bank

The Banister Bend Mitigation Bank (Banister Bend Bank) (NAO-2009-0523) is located in Pittsylvania County, Virginia. The banking instrument for this bank is held by Banister Bend

Farms and was approved in 2004 and amended in 2008. The primary service area for the Banister Bend Bank is the Banister 9-digit HUC. Pursuant to the Virginia Standards for Use and Development of Wetlands (Code of Virginia, Chapter 1, Title 33, Article 15 28.2-1308), a mitigation bank can have a mitigation service area of all Hydrologic Unit Codes within the same river basin. Under this ruling, the bank may also service the adjacent HUCs Upper Roanoke, Middle Roanoke, Upper Dan, and Lower Dan. Mountain Valley utilized credits from the Graham and David Bank to offset permanent wetland impacts in the Upper Roanoke and Banister 8-digit HUCs. The one exception to this was the use of the Virginia Aquatic Resources Trust Fund (VARTF) for forested wetland conversion impacts in the Upper Roanoke 8-digit HUC (See Section 5.3.8).

1.8 VARTF

The VARTF is an approved ILF program, operates in Virginia, and is run by The Nature Conservancy (TNC). The VARTF was approved by a Memorandum of Understanding between the TNC and the USACE (1995) and currently operates under an approved Program Instrument (2019) between the TNC, the USACE, and the VADEQ. The VARTF operates in thirteen out of Virginia's fourteen river basins. Credits from the VARTF have been purchased to offset forested wetland conversion impacts in the Upper Roanoke 8-digit HUC. Please note that the Virginia ILF program operates differently than the ILF program in West Virginia.

EXHIBIT B

PROPOSED TEMPORAL MITIGATION REQUIREMENTS FOR STREAMS AND WETLANDS

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-ME1	Wetzel	Huntington	North Fork Fishing Creek	PEM	ATWS	0.0382	0.0382	-	0.0023
W-ME2	Wetzel	Huntington	North Fork Fishing Creek	PEM	ATWS	0.1036	0.1036	-	0.0062
W-ME3	Wetzel	Huntington	North Fork Fishing Creek	PEM	ATWS	0.0869	0.0869	-	0.0052
W-A1a	Wetzel	Huntington	North Fork Fishing Creek	PEM	Pipeline ROW	0.0038	0.0038	-	0.0002
W-A2a	Wetzel	Huntington	North Fork Fishing Creek	PEM	Timber Mat Crossing	0.0424	0.0424	0.0076	-
W-A4a	Wetzel	Huntington	North Fork Fishing Creek	PEM	Timber Mat Crossing	0.0070	0.0070	-	0.0004
W-IJ31	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	ATWS	0.0992	0.0992	0.0179	-
W-A27-PEM	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	Pipeline ROW	0.0497	0.0497	-	0.0030
W-A35	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	Timber Mat Crossing	0.0066	0.0066	0.0012	-
W-A34	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	Pipeline ROW	0.0296	0.0296	-	0.0018
W-WX5	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	Temporary Access Road	0.0011	0.0011	0.0002	-
W-WX4	Wetzel	Huntington	Headwaters South Fork Fishing Creek	PEM	Temporary Access Road	0.0095	0.0095	0.0017	-
W-B55	Harrison	Pittsburgh	Little Tenmile Creek	PEM	Timber Mat Crossing	0.0054	0.0054	0.0010	-
W-J32-PEM-1	Harrison	Pittsburgh	Little Tenmile Creek	PEM	Temporary Access Road	0.0417	0.0417	0.0075	-
W-A10a	Harrison	Pittsburgh	Outlet Tenmile Creek	PEM	Timber Mat Crossing	0.0153	0.0153	0.0028	-
W-B1a	Harrison	Pittsburgh	Outlet Tenmile Creek	PEM	Pipeline ROW	0.0119	0.0119	-	0.0007
W-A40	Harrison	Pittsburgh	Outlet Tenmile Creek	PEM	Pipeline ROW/ATWS	0.3111	0.3111	-	0.0187
W-A39	Harrison	Pittsburgh	Outlet Tenmile Creek	PEM	Permanent Access Road	0.0280	0.0280	0.0050	-
W-ST11	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Temporary Access Road/ATWS	0.0228	0.0228	0.0041	-
W-ST12-PEM	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Temporary Access Road/ATWS	0.0582	0.0582	0.0105	-
W-B2a	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	ATWS	0.1953	0.1953	0.0352	-
W-B4a	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Timber Mat Crossing	0.0214	0.0214	0.0039	-
W-UU4a	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Pipeline ROW/ATWS	0.1268	0.1268	-	0.0076
W-F52	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Temporary Access Road	0.0625	0.0625	0.0113	-
W-F54	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Timber Mat Crossing	0.0042	0.0042	0.0008	-
W-F53	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Timber Mat Crossing	0.0080	0.0080	0.0014	-
W-F55	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Timber Mat Crossing	0.0173	0.0173	0.0031	-
W-K43	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Pipeline ROW	0.2086	0.2086	-	0.0125
W-K44	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Pipeline ROW	0.0671	0.0671	-	0.0040
W-K52	Doddridge	Huntington	Buckeye Creek	PEM	Permanent Access Road	0.0021	0.0021	0.0004	-
W-K45	Doddridge	Huntington	Buckeye Creek	PEM	Pipeline ROW	0.0401	0.0401	-	0.0024
W-CV15	Harrison	Pittsburgh	Headwaters Tenmile Creek	PEM	Timber Mat Crossing	0.0512	0.0512	0.0092	-
W-K41	Doddridge	Huntington	Meathouse Fork	PEM	Timber Mat Crossing	0.0109	0.0109	0.0020	-
W-A23	Doddridge	Huntington	Meathouse Fork	PEM	Pipeline ROW	0.2701	0.2701	-	0.0162
W-J40	Lewis	Pittsburgh	Kincheloe Creek	PEM	Pipeline ROW	0.2931	0.2931	-	0.0176
W-J40	Lewis	Pittsburgh	Kincheloe Creek	PEM	Temporary Access Road	0.1812	0.1812	-	0.0109
W-A24	Harrison	Pittsburgh	Kincheloe Creek	PEM	Temporary Access Road	0.0002	0.0002	-	0.0000
W-VV5	Lewis	Pittsburgh	Freemans Creek	PEM	ATWS	0.0202	0.0202	0.0036	-
W-IJ23	Lewis	Pittsburgh	Freemans Creek	PEM	Temporary Access Road	0.0065	0.0065	-	0.0004
W-IJ24	Lewis	Pittsburgh	Freemans Creek	PEM	Temporary Access Road	0.0041	0.0041	-	0.0002
W-J20	Lewis	Pittsburgh	Freemans Creek	PEM	Permanent Access Road	0.0081	0.0081	-	0.0005
W-J23	Lewis	Pittsburgh	Freemans Creek	PEM	Pipeline ROW	0.0130	0.0130	-	0.0008
W-B57	Lewis	Huntington	Fink Creek	PEM	Pipeline ROW/Temporary Access Road	0.0336	0.0336	-	0.0020
W-K33-PEM	Lewis	Huntington	Fink Creek	PEM	Pipeline ROW	0.1544	0.1544	-	0.0093
W-K34-PEM	Lewis	Huntington	Fink Creek	PEM	Timber Mat Crossing	0.0253	0.0253	-	0.0015
W-K31	Lewis	Pittsburgh	Freemans Creek	PEM	Pipeline ROW/Temporary Access Road	0.1135	0.1135	-	0.0068
W-ST14	Lewis	Pittsburgh	Freemans Creek	PEM	Anode Bed	0.0394	0.0394	-	0.0024
W-ST15	Lewis	Pittsburgh	Freemans Creek	PEM	Anode Bed	0.0711	0.0711	-	0.0043
W-B46	Lewis	Pittsburgh	Freemans Creek	PEM	Pipeline ROW/Temporary Access Road	0.1255	0.1255	-	0.0075
W-B47	Lewis	Pittsburgh	Freemans Creek	PEM	Timber Mat Crossing	0.0682	0.0682	0.0123	-

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-B51	Lewis	Pittsburgh	Freemans Creek	PEM	Timber Mat Crossing	0.0035	0.0035	0.0006	-
W-B54	Lewis	Pittsburgh	Freemans Creek	PEM	Timber Mat Crossing	0.0101	0.0101	-	0.0006
W-H112	Lewis	Pittsburgh	Polk Creek-West Fork River	PEM	Pipeline ROW	0.0231	0.0231	-	0.0014
W-I22-PEM	Lewis	Huntington	Headwaters Leading Creek	PEM	ATWS	0.0018	0.0018	-	0.0001
W-I22-PEM	Lewis	Huntington	Headwaters Leading Creek	PEM	Timber Mat Crossing	0.0162	0.0162	0.0029	-
W-KK6	Lewis	Huntington	Headwaters Sand Fork	PEM	Timber Mat Crossing	0.0212	0.0212	-	0.0013
W-I15	Lewis	Huntington	Headwaters Sand Fork	PEM	Pipeline ROW	0.0631	0.0631	-	0.0038
W-I16	Lewis	Huntington	Headwaters Sand Fork	PEM	Timber Mat Crossing	0.0177	0.0177	-	0.0011
W-I17	Lewis	Huntington	Headwaters Sand Fork	PEM	Timber Mat Crossing	0.0017	0.0017	-	0.0001
W-I20	Lewis	Huntington	Headwaters Sand Fork	PEM	Timber Mat Crossing	0.0379	0.0379	-	0.0023
W-I21	Lewis	Huntington	Headwaters Sand Fork	PEM	Timber Mat Crossing	0.0631	0.0631	0.0114	-
W-UU7	Lewis	Huntington	Indian Fork	PEM	Pipeline ROW	0.0038	0.0038	-	0.0002
W-H103	Lewis	Huntington	Indian Fork	PEM	Timber Mat Crossing	0.0050	0.0050	-	0.0003
W-H103	Lewis	Huntington	Indian Fork	PEM	ATWS	0.0037	0.0037	-	0.0002
W-H102	Lewis	Huntington	Indian Fork	PEM	ATWS	0.0129	0.0129	-	0.0008
W-H107	Lewis	Huntington	Indian Fork	PEM	Timber Mat Crossing	0.0328	0.0328	-	0.0020
W-H98	Lewis	Huntington	Indian Fork	PEM	Temporary Access Road	0.0032	0.0032	0.0006	-
W-H108	Lewis	Huntington	Indian Fork	PEM	Pipeline ROW	0.0278	0.0278	-	0.0017
W-H96	Lewis	Huntington	Oil Creek	PEM	Timber Mat Crossing	0.0039	0.0039	-	0.0002
W-H95	Lewis	Huntington	Oil Creek	PEM	Timber Mat Crossing	0.0414	0.0414	-	0.0025
W-VV9	Lewis	Huntington	Oil Creek	PEM	Pipeline ROW	0.0534	0.0534	-	0.0032
W-CD17	Lewis	Huntington	Oil Creek	PEM	Timber Mat Crossing	0.0335	0.0335	-	0.0020
W-CD16	Lewis	Huntington	Oil Creek	PEM	Pipeline ROW	0.0226	0.0226	-	0.0014
W-CD16	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road/ ATWS	0.0023	0.0023	0.0004	-
W-VV8	Lewis	Huntington	Oil Creek	PEM	Pipeline ROW	0.0708	0.0708	-	0.0042
W-CD18	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0322	0.0322	0.0058	-
W-CD19	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0080	0.0080	0.0014	-
W-CD21	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0161	0.0161	0.0029	-
W-CD23	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0349	0.0349	0.0063	-
W-CD24	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0094	0.0094	0.0017	-
W-CD36	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0049	0.0049	0.0009	-
W-CD25	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0100	0.0100	0.0018	-
W-CD26	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0114	0.0114	0.0021	-
W-VV10	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0091	0.0091	0.0016	-
W-ST16	Lewis	Huntington	Oil Creek	PEM	Temporary Anode Bed	0.0711	0.0711	-	0.0043
W-VV11	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0246	0.0246	0.0044	-
W-VV12	Lewis	Huntington	Oil Creek	PEM	Temporary Access Road	0.0277	0.0277	0.0050	-
W-VV4-PEM	Lewis	Huntington	Oil Creek	PEM	Timber Mat Crossing	0.0131	0.0131	0.0024	-
W-VV3-PEM	Lewis	Huntington	Oil Creek	PEM	Pipeline ROW	0.0447	0.0447	-	0.0027
W-H90	Braxton	Huntington	Falls Run-Little Kanawha River	PEM	Pipeline ROW	0.0388	0.0388	-	0.0023
W-QR13	Braxton	Huntington	Falls Run-Little Kanawha River	PEM	Temporary Access Road	0.0618	0.0618	0.0111	-
W-QR12	Braxton	Huntington	Falls Run-Little Kanawha River	PEM	Temporary Access Road	0.0881	0.0881	0.0159	-
W-QR11	Braxton	Huntington	Falls Run-Little Kanawha River	PEM	Temporary Access Road	0.0559	0.0559	0.0101	-
W-I11b	Braxton	Huntington	Outlet Holly River	PEM	Timber Mat Crossing	0.0098	0.0098	-	0.0006
W-R2	Webster	Huntington	Outlet Holly River	PEM	Temporary Access Road	0.0620	0.0620	0.0112	-
W-KK3	Webster	Huntington	Outlet Holly River	PEM	Pipeline ROW	0.0222	0.0222	-	0.0013
W-R3	Webster	Huntington	Outlet Holly River	PEM	Temporary Access Road	0.0155	0.0155	0.0028	-

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-F46	Webster	Huntington	Outlet Holly River	PEM	Timber Mat Crossing	0.0039	0.0039	0.0007	-
W-R4	Webster	Huntington	Outlet Holly River	PEM	Temporary Access Road	0.0432	0.0432	0.0078	-
W-H75	Webster	Huntington	Big Run-Elk River	PEM	Pipeline ROW	0.0108	0.0108	-	0.0006
W-H79	Webster	Huntington	Big Run-Elk River	PEM	Timber Mat Crossing	0.0077	0.0077	-	0.0005
W-H81	Webster	Huntington	Big Run-Elk River	PEM	Timber Mat Crossing	0.0237	0.0237	-	0.0014
W-H82	Webster	Huntington	Big Run-Elk River	PEM	Timber Mat Crossing	0.0128	0.0128	-	0.0008
W-H86	Webster	Huntington	Upper Sutton Lake-Elk River	PEM	Pipeline ROW	0.0013	0.0013	-	0.0001
W-H83	Webster	Huntington	Upper Sutton Lake-Elk River	PEM	Pipeline ROW/Temporary Access Road	0.0177	0.0177	-	0.0011
W-T4	Webster	Huntington	Upper Sutton Lake-Elk River	PEM	Temporary Access Road	0.0403	0.0403	0.0073	-
W-H85	Webster	Huntington	Upper Sutton Lake-Elk River	PEM	Pipeline ROW	0.0069	0.0069	-	0.0004
W-A20-PEM	Webster	Huntington	Outlet Laurel Creek	PEM	Timber Mat Crossing	0.0117	0.0117	-	0.0007
W-A19	Webster	Huntington	Outlet Laurel Creek	PEM	Temporary Access Road	0.0265	0.0265	-	0.0016
W-H64-PEM	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0276	0.0276	-	0.0017
W-H64-PEM-2	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0289	0.0289	-	0.0017
W-H56	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0206	0.0206	-	0.0012
W-KL8	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0976	0.0976	-	0.0059
W-H60	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0495	0.0495	-	0.0030
W-H61	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0094	0.0094	-	0.0006
W-H62	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0335	0.0335	-	0.0020
W-B39	Webster	Huntington	Outlet Laurel Creek	PEM	Pipeline ROW	0.0906	0.0906	-	0.0054
W-B31	Webster	Huntington	Headwaters Laurel Creek	PEM	Pipeline ROW	0.0515	0.0515	-	0.0031
W-A18	Webster	Huntington	Headwaters Laurel Creek	PEM	Temporary Access Road	0.2038	0.2038	-	0.0122
W-F26	Webster	Huntington	Upper Birch River	PEM	Timber Mat Crossing	0.0045	0.0045	-	0.0003
W-F29	Webster	Huntington	Upper Birch River	PEM	Timber Mat Crossing	0.0071	0.0071	0.0013	-
W-F28	Webster	Huntington	Upper Birch River	PEM	Timber Mat Crossing	0.0071	0.0071	0.0013	-
W-F41	Webster	Huntington	Upper Birch River	PEM	Temporary Access Road	0.0002	0.0002	-	0.0000
W-B30	Webster	Huntington	Upper Birch River	PEM	Pipeline ROW	0.0429	0.0429	-	0.0026
W-B28	Webster	Huntington	Upper Birch River	PEM	Pipeline ROW	0.0992	0.0992	-	0.0060
W-E21	Webster	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0389	0.0389	-	0.0023
W-E18-PEM	Webster	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0208	0.0208	-	0.0012
W-E16	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Timber Mat Crossing	0.0091	0.0091	-	0.0005
W-F13	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0394	0.0394	-	0.0024
W-F12	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0576	0.0576	-	0.0035
W-F11	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0652	0.0652	-	0.0039
W-K23	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0489	0.0489	-	0.0029
W-K20	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Timber Mat Crossing	0.0100	0.0100	-	0.0006
W-IJ51	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0410	0.0410	-	0.0025
W-IJ50	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0528	0.0528	-	0.0032
W-IJ55	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0218	0.0218	-	0.0013
W-B27	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Timber Mat Crossing	0.0874	0.0874	-	0.0052
W-B26-PEM-1	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Temporary Access Road	0.0273	0.0273	-	0.0016
W-B26-PEM-2	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Temporary Access Road	0.0060	0.0060	-	0.0004
W-FF6-PEM	Nicholas	Huntington	Big Laurel Creek-Gauley River	PEM	Pipeline ROW	0.0793	0.0793	-	0.0048
W-FF3	Nicholas	Huntington	Big Beaver Creek	PEM	Pipeline ROW	0.0444	0.0444	-	0.0027
W-FF4	Nicholas	Huntington	Big Beaver Creek	PEM	Pipeline ROW	0.0037	0.0037	-	0.0002
W-A17	Nicholas	Huntington	Big Beaver Creek	PEM	Pipeline ROW	0.1300	0.1300	-	0.0078
W-H53	Nicholas	Huntington	Big Beaver Creek	PEM	Pipeline ROW	0.0039	0.0039	-	0.0002

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-H50	Nicholas	Huntington	Big Beaver Creek	PEM	Temporary Access Road	0.0114	0.0114	0.0021	-
W-N25	Nicholas	Huntington	Big Beaver Creek	PEM	Timber Mat Crossing	0.0104	0.0104	0.0019	-
W-N24	Nicholas	Huntington	Big Beaver Creek	PEM	Timber Mat Crossing	0.0031	0.0031	-	0.0002
W-N22	Nicholas	Huntington	Big Beaver Creek	PEM	Timber Mat Crossing	0.0030	0.0030	-	0.0002
W-CV13	Nicholas	Huntington	Panther Creek-Gauley River	PEM	Permanent Access Road	0.0159	0.0159	0.0029	-
W-CV12	Nicholas	Huntington	Panther Creek-Gauley River	PEM	Temporary Access Road	0.0098	0.0098	0.0018	-
W-RS04	Nicholas	Huntington	Panther Creek-Gauley River	PEM	Temporary Access Road	0.0254	0.0254	0.0046	-
W-MN4	Nicholas	Huntington	Panther Creek-Gauley River	PEM	Temporary Access Road	0.0463	0.0463	-	0.0028
W-N18	Nicholas	Huntington	Outlet Hominy Creek	PEM	Pipeline ROW	0.0075	0.0075	-	0.0005
W-L28	Nicholas	Huntington	Outlet Hominy Creek	PEM	Pipeline ROW	0.0064	0.0064	-	0.0004
W-L27	Nicholas	Huntington	Outlet Hominy Creek	PEM	Timber Mat Crossing	0.0029	0.0029	0.0005	-
W-I11a	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Pipeline ROW	0.0579	0.0579	-	0.0035
W-U7	Nicholas	Huntington	Headwaters Hominy Creek	PEM	ATWS	0.0666	0.0666	-	0.0040
W-I5	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Pipeline ROW	0.0082	0.0082	-	0.0005
W-VV2	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Timber Mat Crossing	0.0136	0.0136	0.0024	-
W-N16	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Timber Mat Crossing	0.0232	0.0232	-	0.0014
W-H41	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Timber Mat Crossing	0.0151	0.0151	0.0027	-
W-H33	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Pipeline ROW	0.0590	0.0590	-	0.0035
W-H31	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Pipeline ROW	0.0139	0.0139	-	0.0008
W-EF31	Nicholas	Huntington	Headwaters Hominy Creek	PEM	Pipeline ROW/ATWS	0.0208	0.0208	-	0.0012
W-M18	Greenbrier	Huntington	Anglins Creek	PEM	Timber Mat Crossing	0.0364	0.0364	-	0.0022
W-M20	Greenbrier	Huntington	Anglins Creek	PEM	Pipeline ROW	0.0031	0.0031	-	0.0002
W-M23	Greenbrier	Huntington	Anglins Creek	PEM	Pipeline ROW	0.0616	0.0616	-	0.0037
W-ST27	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0075	0.0075	0.0014	-
W-KL40	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0312	0.0312	0.0056	-
W-ST28	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0310	0.0310	0.0056	-
W-IJ60	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0174	0.0174	0.0031	-
W-IJ59	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0024	0.0024	0.0004	-
W-IJ58-PEM-3	Greenbrier	Huntington	Meadow Creek-Meadow River	PEM	Temporary Access Road	0.0056	0.0056	0.0010	-
W-V6	Greenbrier	Huntington	Big Clear Creek-Meadow River	PEM	Temporary Access Road	0.0422	0.0422	0.0076	-
W-QR2	Greenbrier	Huntington	Big Clear Creek-Meadow River	PEM	Pipeline ROW/Temporary Access Road	0.2435	0.2435	0.0438	-
W-L16	Greenbrier	Huntington	Big Clear Creek-Meadow River	PEM	Pipeline ROW	0.0247	0.0247	-	0.0015
W-L19	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW/Temporary Access Road	0.1060	0.1060	-	0.0064
W-L13	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW	0.0316	0.0316	-	0.0019
W-L12	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW	0.0075	0.0075	-	0.0005
W-L11	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW	0.0194	0.0194	-	0.0012
W-L4	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW	0.0404	0.0404	-	0.0024
W-L2	Greenbrier	Huntington	Sewell Creek	PEM	Pipeline ROW/Temporary Access Road	0.0393	0.0393	0.0071	-
W-W10	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Temporary Access Road	0.0488	0.0488	-	0.0029
W-K7	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.0078	0.0078	-	0.0005
W-K7	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.3206	0.3206	-	0.0192
W-IJ30	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.3236	0.3236	-	0.0194
W-UV9	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.1090	0.1090	-	0.0065
W-UV11	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.0285	0.0285	-	0.0017
W-UV10	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.0035	0.0035	-	0.0002
W-K9-PEM-1	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.0354	0.0354	-	0.0021
W-K10	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.0068	0.0068	-	0.0004

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-UV8	Greenbrier	Huntington	Otter Creek-Meadow River	PEM	Pipeline ROW	0.4913	0.4913	-	0.0295
W-EE4	Summers	Huntington	Lick Creek	PEM	Pipeline ROW	0.0453	0.0453	-	0.0027
W-M2	Summers	Huntington	Lick Creek	PEM	Pipeline ROW	0.1064	0.1064	-	0.0064
W-EF40	Summers	Huntington	Hungard Creek-Greenbrier River	PEM	Pipeline ROW	0.0889	0.0889	-	0.0053
W-EF36	Summers	Huntington	Hungard Creek-Greenbrier River	PEM	Timber Mat Crossing	0.0035	0.0035	-	0.0002
W-K2-PEM	Summers	Huntington	Hungard Creek-Greenbrier River	PEM	Pipeline ROW	0.0140	0.0140	-	0.0008
W-G7	Summers	Huntington	Hungard Creek-Greenbrier River	PEM	Timber Mat Crossing	0.0121	0.0121	-	0.0007
W-OP1	Monroe	Huntington	Stony Creek-Greenbrier River	PEM	Pipeline ROW	0.1359	0.1359	-	0.0082
W-A13	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW/Temporary Access Road	0.2991	0.2991	0.0538	-
W-MN14	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW/Access Road/ATWS	0.0390	0.0390	-	0.0023
W-MN15	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW	0.0070	0.0070	-	0.0004
W-MN18-PEM	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW	0.0510	0.0510	-	0.0031
W-MN1	Monroe	Huntington	Middle Indian Creek	PEM	Timber Mat Crossing	0.0187	0.0187	-	0.0011
W-G6	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW	0.0684	0.0684	-	0.0041
W-MN24	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW	0.0100	0.0100	-	0.0006
W-CV25-PEM-2	Monroe	Huntington	Middle Indian Creek	PEM	Pipeline ROW	0.0200	0.0200	-	0.0012
W-E12	Monroe	Huntington	Rich Creek	PEM	Pipeline ROW	0.0041	0.0041	-	0.0002
W-C14	Monroe	Huntington	Rich Creek	PEM	Pipeline ROW	0.0113	0.0113	-	0.0007
W-C13	Monroe	Huntington	Rich Creek	PEM	Pipeline ROW	0.2172	0.2172	-	0.0130
W-C17	Monroe	Huntington	Rich Creek	PEM	Temporary Access Road	0.0306	0.0306	0.0055	-
W-Z11	Giles	Norfolk	Little Stony Creek-New River	PEM	Pipeline ROW	0.0262	0.0262	-	0.0016
W-CD12	Giles	Norfolk	Upper Sinking Creek	PEM	Pipeline ROW	0.0208	0.0208	-	0.0012
W-MM10	Giles	Norfolk	Upper Sinking Creek	PEM	Temporary Access Road	0.0254	0.0254	0.0046	-
W-RR1b	Giles	Norfolk	Upper Sinking Creek	PEM	Timber Mat Crossing	0.0056	0.0056	-	0.0003
W-IJ46-PEM	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	PEM	Pipeline ROW	0.0294	0.0294	-	0.0018
W-AD4	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	PEM	Temporary Access Road	0.0069	0.0069	-	0.0004
W-NN6	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	PEM	Timber Mat Crossing	0.0083	0.0083	-	0.0005
W-C12-PEM	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	PEM	Pipeline ROW	0.2066	0.2066	-	0.0124
W-C6	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	PEM	Timber Mat Crossing	0.0139	0.0139	0.0025	-
W-C5	Montgomery	Norfolk	Bradshaw Creek-North Fork Roanoke River	PEM	Pipeline ROW	0.0454	0.0454	-	0.0027
W-AB7	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	PEM	Timber Mat Crossing	0.0040	0.0040	-	0.0002
W-IJ94-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Timber Mat Crossing	0.0202	0.0202	-	0.0012
W-IJ96-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Temporary Access Road	0.0161	0.0161	-	0.0010
W-EF42	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0083	0.0083	-	0.0005
W-HS02	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.2893	0.2893	-	0.0174
W-AB6-PEM-2	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.3271	0.3271	-	0.0196
W-AB6-PEM-1	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0647	0.0647	-	0.0039
W-AB3-PEM-2	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.1547	0.1547	-	0.0093
W-KL48-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0063	0.0063	-	0.0004
W-KL50	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0408	0.0408	-	0.0024
W-KL49	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0152	0.0152	-	0.0009
W-KL51-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0063	0.0063	-	0.0004
W-MN7-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0116	0.0116	-	0.0007
W-EF44	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.0085	0.0085	-	0.0005
W-IJ62	Roanoke	Norfolk	Bottom Creek	PEM	Temporary Access Road	0.0001	0.0001	0.0000	-
W-Y2	Roanoke	Norfolk	Bottom Creek	PEM	Timber Mat Crossing	0.0189	0.0189	-	0.0011
W-IJ10	Roanoke	Norfolk	Bottom Creek	PEM	Permanent Access Road	0.0020	0.0020	-	0.0001

Wetland ID	County	USACE District	HUC 12 Name	Cowardin Class	Project Activity	Proposed Temporary Fill (acres)	Unit Score	Existing Temporary Fill Mitigation (6 years @ 3%)	Wetland Temporal Mitigation (2 years @ 3%)
W-Q11	Roanoke	Norfolk	Bottom Creek	PEM	Permanent Access Road	0.0130	0.0130	0.0023	-
W-KL1	Roanoke	Norfolk	Bottom Creek	PEM	Permanent Access Road	0.0018	0.0018	0.0003	-
W-B25-PEM-4	Roanoke	Norfolk	Bottom Creek	PEM	Timber Mat Crossing	0.0093	0.0093	-	0.0006
W-B25-PEM-1	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.1934	0.1934	-	0.0116
W-B24-PEM	Roanoke	Norfolk	Bottom Creek	PEM	Pipeline ROW	0.1031	0.1031	-	0.0062
W-B25-PEM-1	Roanoke	Norfolk	Bottom Creek	PEM	Timber Mat Crossing	0.0140	0.0140	-	0.0008
W-B25-PEM-2	Roanoke	Norfolk	Bottom Creek	PEM	Timber Mat Crossing	0.0048	0.0048	-	0.0003
W-ST2-PEM	Franklin	Norfolk	South Fork Blackwater River	PEM	Pipeline ROW	0.1142	0.1142	-	0.0069
W-RR4	Franklin	Norfolk	South Fork Blackwater River	PEM	Permanent Access Road	0.0216	0.0216	0.0039	-
W-RR3	Franklin	Norfolk	South Fork Blackwater River	PEM	Permanent Access Road	0.0019	0.0019	0.0003	-
W-KL41	Franklin	Norfolk	South Fork Blackwater River	PEM	Permanent Access Road	0.0229	0.0229	0.0041	-
W-D7-PEM	Franklin	Norfolk	North Fork Blackwater River	PEM	Pipeline ROW	0.0159	0.0159	-	0.0010
W-EF3	Franklin	Norfolk	South Fork Blackwater River	PEM	Permanent Access Road	0.0265	0.0265	0.0048	-
W-IJ1	Franklin	Norfolk	North Fork Blackwater River	PEM	Pipeline ROW	0.0416	0.0416	-	0.0025
W-IJ2-PEM	Franklin	Norfolk	North Fork Blackwater River	PEM	Timber Mat Crossing	0.0036	0.0036	0.0006	-
W-II8	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Timber Mat Crossing	0.0088	0.0088	0.0016	-
W-IJ6	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Timber Mat Crossing	0.0046	0.0046	-	0.0003
W-E7	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Pipeline ROW	0.2123	0.2123	-	0.0127
W-E8	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Pipeline ROW	0.0691	0.0691	-	0.0041
W-EF51	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Pipeline ROW	0.0133	0.0133	-	0.0008
W-KL43b	Franklin	Norfolk	Maggodee Creek	PEM	Pipeline ROW	0.0004	0.0004	-	0.0000
W-CD6	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Pipeline ROW	0.0934	0.0934	-	0.0056
W-EF48	Franklin	Norfolk	Madcap Creek-Blackwater River	PEM	Pipeline ROW	0.0080	0.0080	-	0.0005
W-DD1	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	PEM	Pipeline ROW	0.0813	0.0813	-	0.0049
W-A12-PEM	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	PEM	Pipeline ROW	0.0651	0.0651	-	0.0039
W-H11	Franklin	Norfolk	Owens Creek-Pigg River	PEM	Pipeline ROW	0.0468	0.0468	-	0.0028
W-H16	Franklin	Norfolk	Owens Creek-Pigg River	PEM	Pipeline ROW	0.0232	0.0232	-	0.0014
W-H14	Franklin	Norfolk	Owens Creek-Pigg River	PEM	Timber Mat Crossing	0.0061	0.0061	-	0.0004
W-A8	Franklin	Norfolk	Owens Creek-Pigg River	PEM	Pipeline ROW	0.0154	0.0154	-	0.0009
W-H9	Franklin	Norfolk	Owens Creek-Pigg River	PEM	Pipeline ROW	0.0085	0.0085	-	0.0005
W-H6	Franklin	Norfolk	Tomahawk Creek-Pigg River	PEM	Pipeline ROW	0.0057	0.0057	-	0.0003
W-MM17	Franklin	Norfolk	Tomahawk Creek-Pigg River	PEM	Pipeline ROW	0.0068	0.0068	-	0.0004
W-B5	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	PEM	Pipeline ROW	0.0048	0.0048	-	0.0003
W-C1	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	PEM	Timber Mat Crossing	0.0182	0.0182	-	0.0011
W-H5	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	PEM	Pipeline ROW	0.2067	0.2067	-	0.0124
W-B3	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Timber Mat Crossing	0.0013	0.0013	-	0.0001
W-CC2-PEM	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Timber Mat Crossing	0.0272	0.0272	-	0.0016
W-MM9	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0108	0.0108	-	0.0006
W-MM8-PEM	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0553	0.0553	-	0.0033
W-Q1	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0146	0.0146	-	0.0009
W-G2	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0346	0.0346	-	0.0021
W-H1	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0110	0.0110	-	0.0007
W-H2	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.7987	0.7987	-	0.0479
W-H3	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Pipeline ROW	0.0509	0.0509	-	0.0031
W-IJ22-PEM	Pittsylvania	Norfolk	Cherrystone Creek	PEM	Timber Mat Crossing	0.0390	0.0390	-	0.0023

Stream ID	NHD Stream Name	County	USACE District	HUC 12 Name	Flow Regime	Project Activity	Mitigation Scoring				
							Index	Proposed Temporary Impact (Linear Feet)	Unit Score	Existing Temporary Fill Mitigation (5 years @ 3%)	Proposed Temporal Mitigation (1 Years)
S-ST18	UNT to Mobley Run	Wetzel	Huntington	North Fork Fishing Creek	Intermittent	Permanent Access Road	0.584	21	12.26	1.84	-
S-WX3	UNT to Mobley Run	Wetzel	Huntington	North Fork Fishing Creek	Intermittent	ATWS	0.574	21	12.05	-	0.36
S-A1a	North Fork Fishing Creek	Wetzel	Huntington	North Fork Fishing Creek	Perennial	Pipeline ROW	0.722	80	57.76	-	1.73
S-A3a	UNT to North Fork Fishing Creek	Wetzel	Huntington	North Fork Fishing Creek	Intermittent	Pipeline ROW	0.610	80	48.80	-	1.46
S-J66	UNT to North Fork Fishing Creek	Wetzel	Huntington	North Fork Fishing Creek	Intermittent	Timber Mat Crossing	0.756	20	15.12	2.27	-
S-A5a	UNT to Fallen Timber Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Timber Mat Crossing	0.580	30	17.40	2.61	-
S-A6a	Fallen Timber Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Timber Mat Crossing	0.797	20	15.94	2.39	-
S-A125	Price Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Timber Mat Crossing	0.725	20	14.50	2.18	-
S-A124	UNT to Price Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Pipeline ROW	0.667	100	66.70	-	2.00
S-A118	UNT to Price Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Pipeline ROW	0.763	79	60.28	-	1.81
S-A120 TEMP AR 1	Stout Run TEMP AR 1	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Temporary Access Road	0.570	8	4.56	0.27	-
S-A120 TEMPA R 2	Stout Run TEMP AR 2	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Temporary Access Road	0.533	9	4.80	0.29	-
S-A120 TM	Stout Run TM	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Pipeline ROW	0.631	20	12.62	-	0.38
S-A119	UNT to Stout Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Pipeline ROW	0.612	134	82.01	-	2.46
S-QR34 TEMP AR	UNT to Stout Run TEMP AR	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Ephemeral	Temporary Access Road	0.467	8	3.74	0.22	-
S-J60	Sams Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Timber Mat Crossing	0.697	20	13.94	0.84	-
S-J56 TM	Manion Run TM	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Timber Mat Crossing	0.725	20	14.50	0.87	-
S-J56 TEMP AR	Manion Run TEMP AR	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Temporary Access Road	0.857	23	19.71	1.18	-
S-J59 TEMP AR	UNT to Manion Run TEMP AR	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Intermittent	Temporary Access Road	0.565	10	5.65	0.34	-
S-J58	UNT to Manion Run	Wetzel	Huntington	Headwaters South Fork Fishing Creek	Perennial	Permanent Access Road	0.728	26	18.93	1.14	-
S-J62	Right Fork Big Elk Creek	Harrison	Pittsburgh	Little Tenmile Creek	Perennial	Timber Mat Crossing	0.813	20	16.26	0.98	-
S-B75/F49	UNT to Goose Run	Harrison	Pittsburgh	Little Tenmile Creek	Intermittent	Timber Mat Crossing	0.678	20	13.56	0.81	-
S-B74	Goose Run	Harrison	Pittsburgh	Little Tenmile Creek	Intermittent	Timber Mat Crossing	0.783	20	15.66	0.94	-
S-B79	UNT to Big Elk Creek	Harrison	Pittsburgh	Little Tenmile Creek	Ephemeral	Temporary Access Road	0.431	11	4.74	0.28	-
S-B79	UNT to Big Elk Creek	Harrison	Pittsburgh	Little Tenmile Creek	Ephemeral	Temporary Access Road	0.515	24	12.36	0.74	-
S-J51	Little Tenmile Creek	Harrison	Pittsburgh	Little Tenmile Creek	Perennial	Timber Mat Crossing	0.765	20	15.30	0.92	-
S-A10a	Little Rockcamp Run	Harrison	Pittsburgh	Outlet Tenmile Creek	Perennial	Timber Mat Crossing	0.698	20	13.96	0.84	-
S-B2a	UNT to Rockcamp Run	Harrison	Pittsburgh	Outlet Tenmile Creek	Ephemeral	Pipeline ROW	0.502	115	57.73	-	1.73
S-B3a	Rockcamp Run	Harrison	Pittsburgh	Outlet Tenmile Creek	Perennial	Pipeline ROW	0.793	97	76.92	-	2.31
S-RR22	UNT to Grass Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Timber Mat Crossing	0.721	20	14.42	0.87	-
S-A11a	Grass Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Pipeline ROW	0.838	113	94.69	-	2.84
S-A11a-Braid-1	Grass Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Intermittent	Pipeline ROW	0.625	11	6.88	-	0.21
S-A11a-Braid-2	Grass Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Intermittent	Pipeline ROW	0.610	77	46.97	-	1.41
S-B6a TEMP AR[1]	Indian Run TEMP AR	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Temporary Access Road	0.835	30	25.05	1.50	-
S-B6a TM	Indian Run TM	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Timber Mat Crossing	0.835	20	16.70	1.00	-
S-B7a	UNT to Indian Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Intermittent	Timber Mat Crossing	0.548	20	10.96	0.66	-
S-UU3	Salem Fork	Harrison	Pittsburgh	Salem Fork	Perennial	Pipeline ROW	0.858	76	65.21	-	1.96
S-UU5	Halls Run	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Pipeline ROW	0.632	79	49.93	-	1.50
S-K73	Coburn Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Pipeline ROW	0.598	110	65.78	-	1.97
S-K74	UNT to Coburn Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Ephemeral	Pipeline ROW	0.549	36	19.76	-	0.59

MOUNTAIN VALLEY PIPELINE
BASELINE ASSESSMENT WEST VIRGINIA STREAM DATA SUMMARY

Stream ID	NHD Stream Name	County	USACE District	HUC 12 Name	Flow Regime	Project Activity	Mitigation Scoring				
							Index	Proposed Temporary Impact (Linear Feet)	Unit Score	Existing Temporary Fill Mitigation (5 years @ 3%)	Proposed Temporal Mitigation (1 Years)
S-K75	UNT to Coburn Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Intermittent	Pipeline ROW	0.443	96	42.53	-	1.28
S-K77 (1)	Traugh Fork (1)	Doddridge	Huntington	Buckeye Creek	Intermittent	Pipeline ROW	0.641	37	23.72	-	0.71
S-K77 (2)	Traugh Fork (2)	Doddridge	Huntington	Buckeye Creek	Intermittent	Pipeline ROW	0.730	93	67.89	-	2.04
S-K80	UNT to Turtletree Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Intermittent	Timber Mat Crossing	0.458	20	9.16	0.55	-
S-CV9	UNT to Turtletree Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Ephemeral	Timber Mat Crossing	0.484	20	9.68	0.58	-
S-K81	Turtletree Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Timber Mat Crossing	0.675	30	20.25	1.22	-
S-CV10	UNT to Turtletree Fork	Harrison	Pittsburgh	Headwaters Tenmile Creek	Perennial	Timber Mat Crossing	0.789	20	15.78	0.95	-
S-K67	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Intermittent	Pipeline ROW	0.630	77	48.51	-	1.46
S-K65	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Intermittent	Pipeline ROW	0.605	90	54.45	-	1.63
S-K54	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Intermittent	Timber Mat Crossing	0.518	20	10.36	0.62	-
S-K58	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Ephemeral	Timber Mat Crossing	0.555	20	11.10	0.67	-
S-K59	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Ephemeral	Timber Mat Crossing	0.544	20	10.88	0.65	-
S-K60	UNT to Big Issac Creek	Doddridge	Huntington	Meathouse Fork	Ephemeral	Timber Mat Crossing	0.570	20	11.40	0.68	-
S-A110/K62 ROW	UNT to Laural Run ROW	Doddridge	Huntington	Meathouse Fork	Intermittent	Pipeline ROW	0.362	59	21.36	-	0.64
S-A111	Laural Run	Doddridge	Huntington	Meathouse Fork	Perennial	Pipeline ROW	0.828	77	63.76	-	1.91
S-A106[1]	UNT to Kincheloe Creek	Harrison	Pittsburgh	Kincheloe Creek	Ephemeral	Timber Mat Crossing	0.538	168	90.38	5.42	-
S-A105	UNT to Kincheloe Creek	Harrison	Pittsburgh	Kincheloe Creek	Ephemeral	Timber Mat Crossing	0.538	20	10.76	0.65	-
S-K82	UNT to Kincheloe Creek	Harrison	Pittsburgh	Kincheloe Creek	Perennial	Pipeline ROW	0.788	110	86.68	-	2.60
S-K94 TEMP AR	Kincheloe Creek TEMP AR	Lewis	Pittsburgh	Kincheloe Creek	Perennial	Temporary Access Road	0.874	18	15.73	0.94	-
S-K94 ROW	Kincheloe Creek ROW	Lewis	Pittsburgh	Kincheloe Creek	Perennial	Pipeline ROW	0.688	79	54.35	-	1.63
S-I67	Smoke Camp Run	Lewis	Pittsburgh	Freemans Creek	Perennial	Timber Mat Crossing	0.735	22	16.17	-	0.49
S-J43	Right Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Perennial	Timber Mat Crossing	0.815	22	17.93	1.08	-
S-J44	UNT to Right Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Perennial	Pipeline ROW	0.848	79	66.99	-	2.01
S-J46	Fink Creek	Lewis	Huntington	Finks Creek	Perennial	Timber Mat Crossing	0.783	22	17.23	1.03	-
S-J47b	UNT to Fink Creek	Lewis	Huntington	Finks Creek	Intermittent	Timber Mat Crossing	0.655	22	14.41	-	0.43
S-K46	UNT to Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Ephemeral	Pipeline ROW	0.597	93	55.52	-	1.67
S-B67	Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Perennial	Timber Mat Crossing	0.679	22	14.94	0.90	-
S-B69	UNT to Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Ephemeral	Temporary Access Road	0.503	86	43.26	2.60	-
S-H184	UNT to Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Ephemeral	Timber Mat Crossing	0.501	22	11.02	0.66	-
S-H184a	UNT to Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Ephemeral	Timber Mat Crossing	0.523	22	11.51	0.69	-
S-H180	UNT to Left Fork Freemans Creek	Lewis	Pittsburgh	Freemans Creek	Intermittent	Pipeline ROW	0.431	68	29.31	-	0.88
S-I64	Leading Creek	Lewis	Huntington	Headwaters Leading Creek	Perennial	Timber Mat Crossing	0.745	22	16.39	0.98	-
S-KK3a	UNT to Laurel Run	Lewis	Huntington	Headwaters Sand Fork	Ephemeral	Timber Mat Crossing	0.335	22	7.37	0.44	-
S-KK5 (1)	UNT to Laurel Run (1)	Lewis	Huntington	Headwaters Sand Fork	Intermittent	Timber Mat Crossing	0.673	22	14.81	0.89	-
S-KK5 (2)	UNT to Laurel Run (2)	Lewis	Huntington	Headwaters Sand Fork	Intermittent	Timber Mat Crossing	0.603	16	9.65	-	0.29
S-KK5 (3)	UNT to Laurel Run (3)	Lewis	Huntington	Headwaters Sand Fork	Intermittent	Timber Mat Crossing	0.533	16	8.53	-	0.26

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S-KK6	UNT Laurel Run	Lewis	Huntington	Headwaters Sand Fork	Intermittent	Timber Mat Crossing	0.730	22	16.06	0.96	-
S-KK7	Laurel Run	Lewis	Huntington	Headwaters Sand Fork	Perennial	Timber Mat Crossing	0.808	22	17.78	1.07	-
S-K45	UNT to Cove Lick	Lewis	Huntington	Headwaters Sand Fork	Ephemeral	ATWS	0.513	50	25.65	-	0.77
S-K43 TM	Cove Lick TM	Lewis	Huntington	Headwaters Sand Fork	Perennial	Timber Mat Crossing	0.662	22	14.56	0.87	-
S-K38	UNT to Rock Run	Lewis	Huntington	Headwaters Sand Fork	Ephemeral	Timber Mat Crossing	0.484	22	10.65	0.64	-
S-I63 ROW	Sand Fork ROW	Lewis	Huntington	Headwaters Sand Fork	Perennial	Pipeline ROW	0.729	60	43.74	-	1.31
S-I63 TEMP AR	Sand Fork TEMP AR	Lewis	Huntington	Headwaters Sand Fork	Perennial	Temporary Access Road	0.725	8	5.80	0.35	-
S-H160	Indian Fork	Lewis	Huntington	Indian Fork	Perennial	Pipeline ROW	0.770	23	17.71	-	0.53
S-L76	Indian Fork	Lewis	Huntington	Indian Fork	Perennial	Permanent Access Road	0.790	33	26.07	1.56	-
S-H153	UNT to Sugar Camp Run	Lewis	Huntington	Indian Fork	Perennial	Pipeline ROW	0.845	76	64.22	-	1.93
S-H145	UNT to Indian Fork	Lewis	Huntington	Indian Fork	Perennial	Pipeline ROW	0.885	91	80.54	-	2.42
S-H165	UNT to Indian Fork	Lewis	Huntington	Indian Fork	Ephemeral	Pipeline ROW	0.665	144	95.76	-	2.87
S-CV3	Threelick Run	Lewis	Huntington	Oil Creek	Perennial	Timber Mat Crossing	0.659	22	14.50	0.87	-
S-CD16	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Intermittent	Pipeline ROW	0.843	173	145.84	-	4.38
S-VV13	Second Big Run	Lewis	Huntington	Oil Creek	Perennial	Pipeline ROW	0.843	80	67.44	-	2.02
S-VV13d	Second Big Run	Lewis	Huntington	Oil Creek	Perennial	Temporary Access Road	0.860	61	52.46	3.15	-
S-VV13b	Second Big Run	Lewis	Huntington	Oil Creek	Perennial	Temporary Access Road	0.845	42	35.49	2.13	-
S-VV11	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Pipeline ROW	0.696	7	4.87	-	0.15
S-VV12	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Perennial	Pipeline ROW	0.738	77	56.83	-	1.70
S-VV20	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.547	40	21.88	1.31	-
S-VV19	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.799	62	49.54	2.97	-
S-VV18	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.554	41	22.71	1.36	-
S-VV16 (1)	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.608	293	178.14	10.69	-
S-VV16 (2)	UNT to Second Big Run	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.592	211	124.91	7.49	-
S-UV11 ROW	Oil Creek ROW	Lewis	Huntington	Oil Creek	Perennial	Pipeline ROW	0.970	51	49.47	-	1.48
S-VV22	UNT to Oil Creek	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.649	43	27.91	1.67	-
S-VV21	UNT to Oil Creek	Lewis	Huntington	Oil Creek	Ephemeral	Temporary Access Road	0.616	18	11.09	0.67	-
S-VV9	UNT to Clover Fork	Lewis	Huntington	Oil Creek	Perennial	Timber Mat Crossing	0.935	22	20.57	1.23	-
S-VV2	Clover Fork	Braxton	Huntington	Oil Creek	Perennial	Pipeline ROW	0.873	90	78.57	-	2.36
S-L51	Barbecue Run	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Perennial	Timber Mat Crossing	0.825	22	18.15	-	0.54
S-J37[1]	UNT to Barbecue Run[1]	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Intermittent	Timber Mat Crossing	0.825	22	18.15	-	0.54
S-L57	UNT to Barbecue Run	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Ephemeral	Temporary Access Road/ATWS	0.360	25	9.00	0.54	-
S-L60	Left Fork Knawl Creek	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Perennial	Pipeline ROW	0.883	75	66.23	-	1.99
S-LL1	Knawl Creek	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Perennial	Pipeline ROW	0.880	88	77.44	-	2.32
S-QR30	UNT to Little Knawl Creek	Braxton	Huntington	Burnsville Lake-Little Kanawha River	Perennial	Pipeline ROW	0.943	79	74.50	-	2.23
S-JJ1	UNT to Keith Run	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Timber Mat Crossing	0.778	22	17.12	-	0.51
S-I60	UNT to Falls Run	Braxton	Huntington	Falls Run-Little Kanawha River	Intermittent	Timber Mat Crossing	0.392	22	8.62	-	0.26
S-J70	Falls Run	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.973	77	74.92	-	2.25
S-K34	Hemp Patch Run	Braxton	Huntington	Falls Run-Little Kanawha River	Intermittent	Timber Mat Crossing	0.810	22	17.82	-	0.53
S-K33	UNT to Hemp Patch Run	Braxton	Huntington	Falls Run-Little Kanawha River	Ephemeral	Timber Mat Crossing	0.533	22	11.73	-	0.35
S-H123 (1)	UNT to Elliott Run (1)	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.650	82	53.30	-	1.60
S-H123 (2)	UNT to Elliott Run (2)	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.645	82	52.89	-	1.59
S-H127	UNT to Elliott Run	Braxton	Huntington	Falls Run-Little Kanawha River	Intermittent	Timber Mat Crossing	0.528	22	11.62	0.70	-

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S-H132	Little Kanawha River	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Timber Mat Crossing	0.816	120	97.92	5.88	-
S-QR26	UNT to Little Kanawha River	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Temporary Access Road	0.814	54	43.96	2.64	-
S-H129	UNT to Little Kanawha River	Braxton	Huntington	Falls Run-Little Kanawha River	Intermittent	Timber Mat Crossing	0.595	22	13.09	0.79	-
S-H131	UNT to Little Kanawha River	Braxton	Huntington	Falls Run-Little Kanawha River	Ephemeral	Pipeline ROW	0.506	64	32.38		0.97
S-H117	Stonecoal Run	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.814	82	66.75	-	2.00
S-L46	UNT to Laurel Run	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.793	78	61.85	-	1.86
S-L44	UNT to Laurel Run	Braxton	Huntington	Falls Run-Little Kanawha River	Perennial	Pipeline ROW	0.837	81	67.80	-	2.03
S-I57	Mudlick Run	Braxton	Huntington	Outlet Holly River	Perennial	Pipeline ROW	0.805	77	61.99	-	1.86
S-A96/A103	UNT to Left Fork Holly River	Webster	Huntington	Left Fork Holly River	Ephemeral	Pipeline ROW	0.515	83	42.75	-	1.28
S-A97	UNT to Left Fork Holly River	Webster	Huntington	Left Fork Holly River	Intermittent	Pipeline ROW	0.458	125	57.25	-	1.72
S-A99	UNT to Left Fork Holly River	Webster	Huntington	Left Fork Holly River	Ephemeral	Pipeline ROW	0.595	34	20.23	-	0.61
S-A98[1]	UNT to Left Fork Holly River[1]	Webster	Huntington	Left Fork Holly River	Intermittent	Pipeline ROW/Temporary Access Road	0.458	392	179.54	-	5.39
S-A100	Left Fork Holly River	Webster	Huntington	Outlet Holly River	Perennial	Timber Mat Crossing	0.893	22	19.65	-	0.59
S-E78/E82/R1	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Perennial	Pipeline ROW	0.818	102	83.44	-	2.50
S-E76	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Ephemeral	Timber Mat Crossing	0.742	22	16.32	0.98	-
S-KK2	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Ephemeral	Pipeline ROW	0.593	75	44.48	-	1.33
S-KK3b	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Ephemeral	Pipeline ROW	0.619	100	61.90	-	1.86
S-KK4b	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Ephemeral	Pipeline ROW	0.616	88	54.21	-	1.63
S-E74[1]	UNT to Left Fork Holly River	Webster	Huntington	Outlet Holly River	Perennial	~~Pipeline ROW~~	0.818	68	55.62	-	1.67
S-F40	Oldlick Creek	Webster	Huntington	Outlet Holly River	Perennial	Pipeline ROW	0.927	22	20.39	-	0.61
S-S1	UNT to Oldlick Creek	Webster	Huntington	Outlet Holly River	Ephemeral	Pipeline ROW	0.527	21	11.07	-	0.33
S-S4	UNT to Oldlick Creek	Webster	Huntington	Outlet Holly River	Ephemeral	Temporary Access Road	0.655	45	29.48	1.77	
S-F43	UNT to Oldlick Creek	Webster	Huntington	Outlet Holly River	Perennial	Pipeline ROW	0.743	101	75.04	-	2.25
S-E67	Right Fork Holly Creek	Webster	Huntington	Outlet Right Fork Holly River	Perennial	Pipeline ROW	0.865	92	79.58	-	2.39
S-B62 (1)	Narrows Run (1)	Webster	Huntington	Outlet Right Fork Holly River	Perennial	ATWS	0.787	15	11.81	-	0.35
S-E71	UNT to Elk River	Webster	Huntington	Upper Sutton Lake-Elk River	Intermittent	Pipeline ROW	0.528	44	23.23	-	0.70
S-H111 (1)	UNT to Elk River (1)	Webster	Huntington	Upper Sutton Lake-Elk River	Intermittent	Pipeline ROW	0.595	22	13.09	-	0.39
S-H111 (2)	UNT to Elk River (2)	Webster	Huntington	Upper Sutton Lake-Elk River	Intermittent	Pipeline ROW	0.488	22	10.74	-	0.32
S-H114	UNT to Elk River	Webster	Huntington	Upper Sutton Lake-Elk River	Ephemeral	Pipeline ROW	0.521	22	11.46	-	0.34
S-H112	UNT to Elk River	Webster	Huntington	Big Run-Elk River	Intermittent	Pipeline ROW	0.466	22	10.25	-	0.31
S-H113 (1)	UNT to Elk River (1)	Webster	Huntington	Big Run-Elk River	Perennial	Pipeline ROW	0.828	74	61.27	-	1.84
S-H113 (2)[1]	UNT to Elk River (2)[1]	Webster	Huntington	Big Run-Elk River	Perennial	Pipeline ROW	0.828	9	7.45	-	0.22

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S-H113 (3)	UNT to Elk River (3)	Webster	Huntington	Big Run-Elk River	Perennial	Pipeline ROW	0.800	9	7.20	-	0.22
S-H110	UNT to Houston Run	Webster	Huntington	Upper Sutton Lake-Elk River	Ephemeral	Timber Mat Crossing	0.464	22	10.21	-	0.31
S-T29	Houston Run	Webster	Huntington	Upper Sutton Lake-Elk River	Perennial	Pipeline ROW	0.660	76	50.16	-	1.50
S-A83/A91	UNT to Camp Creek	Webster	Huntington	Outlet Laurel Creek	Perennial	Pipeline ROW	0.778	75	58.35	-	1.75
S-A93 TEMP AR[1]	UNT to Camp Creek TEMP AR	Webster	Huntington	Outlet Laurel Creek	Ephemeral	Temporary Access Road	0.429	13	5.58	-	0.17
S-A93 ROW[1]	UNT to Camp Creek ROW	Webster	Huntington	Outlet Laurel Creek	Ephemeral	Pipeline ROW	0.429	105	45.05	-	1.35
S-A92[1]	UNT to Camp Creek	Webster	Huntington	Outlet Laurel Creek	Ephemeral	Pipeline ROW	0.429	59	25.31	-	0.76
S-H108	Lower Laurel Fork	Webster	Huntington	Outlet Laurel Creek	Perennial	Pipeline ROW	0.858	78	66.92	-	2.01
S-H105	UNT to Camp Creek	Webster	Huntington	Outlet Laurel Creek	Perennial	Pipeline ROW	0.723	121	87.48	-	2.62
S-H107	UNT to Camp Creek	Webster	Huntington	Outlet Laurel Creek	Intermittent	Pipeline ROW	0.429	10	4.29	-	0.13
S-H107 ROW	UNT to Camp Creek ROW	Webster	Huntington	Outlet Laurel Creek	Intermittent	Pipeline ROW	0.429	90	38.61	-	1.16
S-H104	Camp Creek	Webster	Huntington	Outlet Laurel Creek	Perennial	Pipeline ROW	0.806	104	83.82	-	2.51
S-H103	UNT to Camp Creek	Webster	Huntington	Outlet Laurel Creek	Intermittent	Pipeline ROW	0.485	37	17.95	-	0.54
S-B34	Amos Run	Webster	Huntington	Outlet Laurel Creek	Perennial	Pipeline ROW	0.538	81	43.58	-	1.31
S-B35	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Intermittent	Pipeline ROW	0.775	80	62.00	-	1.86
S-B36	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.750	72	54.00	-	1.62
S-B37	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Intermittent	Pipeline ROW	0.600	82	49.20	-	1.48
S-B38	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.683	43	29.37	-	0.88
S-B42	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.450	101	45.45	-	1.36
S-B39b (1)	UNT to Amos Run (1)	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.442	142	62.76	-	1.88
S-B45	UNT to Amos Run	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.448	177	79.30	-	2.38
S-B39a/B46 (1)	UNT to Amos Run (1)	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.467	110	51.37	-	1.54
S-B39b (2)	UNT to Amos Run (2)	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.470	3	1.41	-	0.04
S-B39a/B46 (2)	UNT to Amos Run (2)	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Pipeline ROW	0.450	11	4.95	-	0.15
S-O4	Lost Run	Webster	Huntington	Headwaters Laurel Creek	Perennial	Pipeline ROW	0.671	92	61.73	-	1.85
S-O5	UNT to Laurel Creek	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Timber Mat Crossing	0.311	22	6.84	0.41	-
S-A81	UNT to Laurel Creek	Webster	Huntington	Headwaters Laurel Creek	Ephemeral	Temporary Access Road	0.590	81	47.79	2.87	-
S-A79	Laurel Creek	Webster	Huntington	Headwaters Laurel Creek	Perennial	Timber Mat Crossing	0.776	55	42.68	2.56	-
S-A80	UNT to Laurel Creek	Webster	Huntington	Headwaters Laurel Creek	Intermittent	Temporary Access Road	0.390	104	40.56	2.43	-
S-E58	Little Glade Run	Webster	Huntington	Headwaters Laurel Creek	Perennial	Timber Mat Crossing	0.836	22	18.39	1.10	-
S-E55	UNT to Laurel Creek	Webster	Huntington	Upper Birch River	Ephemeral	Timber Mat Crossing	0.508	22	11.18	-	0.34
S-F35	UNT to Birch River	Webster	Huntington	Upper Birch River	Perennial	Timber Mat Crossing	0.575	5	2.88	0.17	-
S-F34	UNT to Birch River	Webster	Huntington	Upper Birch River	Perennial	Timber Mat Crossing	0.809	22	17.80	1.07	-
S-F36a (1)	UNT to Birch River (1)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.730	5	3.65	0.22	-
S-F36a (2)	UNT to Birch River (2)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.795	23	18.29	1.10	-
S-F36a (3)	UNT to Birch River (3)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.638	23	14.67	0.88	-
S-F36a (4)	UNT to Birch River (4)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.691	20	13.82	0.83	-
S-F36b (1)	UNT to Birch River (1)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.661	65	42.97	2.58	-
S-F36b (2)	UNT to Birch River (2)	Webster	Huntington	Upper Birch River	Perennial	Pipeline ROW	0.673	78	52.49	-	1.57
S-F36b (3)	UNT to Birch River (3)	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.813	16	13.01	0.78	-
S-F37	UNT to Birch River	Webster	Huntington	Upper Birch River	Perennial	Temporary Access Road	0.825	20	16.50	0.99	-

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S-C49	UNT to Birch River	Webster	Huntington	Upper Birch River	Ephemeral	Timber Mat Crossing	0.484	22	10.65	0.64	-
S-B33	UNT to Meadow Fork	Webster	Huntington	Upper Birch River	Intermittent	Timber Mat Crossing	0.466	22	10.25	0.62	-
S-B32-Braid	UNT to Meadow Fork	Webster	Huntington	Upper Birch River	Perennial	Pipeline ROW	0.550	22	12.10	-	0.36
S-B32	UNT to Meadow Fork	Webster	Huntington	Upper Birch River	Perennial	Pipeline ROW	0.843	22	18.55	-	0.56
S-B29	Meadow Fork	Webster	Huntington	Upper Birch River	Perennial	Pipeline ROW	0.753	85	64.01	-	1.92
S-E50 (1)	UNT to Gauley River (1)	Webster	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.803	93	74.68	-	2.24
S-E52	UNT to Gauley River	Webster	Huntington	Big Laurel Creek-Gauley River	Intermittent	Timber Mat Crossing	0.453	22	9.97	0.60	-
S-E50 (2)	UNT to Gauley River (2)	Webster	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.753	82	61.75	-	1.85
S-E49	UNT to Gauley River	Nicholas	Huntington	Big Laurel Creek-Gauley River	Ephemeral	Pipeline ROW	0.498	88	43.82	-	1.31
S-E46 TM	Strouds Creek TM	Webster	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.698	22	15.36	-	0.46
S-E46 TEMP AR	Strouds Creek TEMP AR	Webster	Huntington	Big Laurel Creek-Gauley River	Perennial	Temporary Access Road	0.830	43	35.69	2.14	-
S-F21	Barn Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Timber Mat Crossing	0.675	18	12.15	0.73	-
S-F20	Barn Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.643	22	14.15	-	0.42
S-IJ57	UNT to Barn Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.748	82	61.34	-	1.84
S-IJ59	UNT to Barn Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Ephemeral	Timber Mat Crossing	0.511	22	11.24	-	0.34
S-IJ60	UNT to Rockcamp Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.833	77	64.14	-	1.92
S-IJ62	UNT to Cherry Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Intermittent	Pipeline ROW	0.408	79	32.23	-	0.97
S-B28	Cherry Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.593	22	13.05	-	0.39
S-B26	UNT to Cherry Run	Nicholas	Huntington	Big Laurel Creek-Gauley River	Intermittent	Temporary Access Road	0.495	43	21.29	1.28	-
S-J32	Big Beaver Creek	Nicholas	Huntington	Big Laurel Creek-Gauley River	Perennial	Pipeline ROW	0.658	22	14.48	-	0.43
S-A76	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.680	77	52.36	-	1.57
S-A75	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.813	84	68.29	-	2.05
S-A74	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Ephemeral	Pipeline ROW	0.398	75	29.85	-	0.90
S-A73	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.475	83	39.43	-	1.18
S-A72	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Ephemeral	Pipeline ROW	0.740	22	16.28	-	0.49
S-A71	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.613	22	13.49	-	0.40
S-A71-Braid	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.486	22	10.69	-	0.32
S-A67	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.835	76	63.46	-	1.90
S-A69(1)	UNT to Big Beaver Creek (1)	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.528	82	43.30	-	1.30
S-A69(2)[1]	UNT to Big Beaver Creek (2)[1]	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.528	16	8.45	-	0.25
S-H99	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.813	96	78.05	-	2.34
S-H96	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Intermittent	Temporary Access Road	0.426	39	16.61	1.00	-
S-H95	UNT to Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Ephemeral	Temporary Access Road	0.568	259	147.11	-	4.41
S-A65	Big Beaver Creek	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.720	77	55.44	-	1.66
S-A64	UNT to Granny Run	Nicholas	Huntington	Big Beaver Creek	Ephemeral	Pipeline ROW	0.400	54	21.60	-	0.65
S-N15	UNT to Granny Run	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.456	22	10.03	-	0.30
S-N14 (1)	Granny Run (1)	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.628	22	13.82	-	0.41
S-N14 (2)	Granny Run (2)	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.700	22	15.40	-	0.46
S-I43	UNT to Big Run	Nicholas	Huntington	Big Beaver Creek	Intermittent	Pipeline ROW	0.563	22	12.39	-	0.37
S-I44	Big Run	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.820	22	18.04	-	0.54
S-I45	UNT to Big Run	Nicholas	Huntington	Big Beaver Creek	Perennial	Pipeline ROW	0.815	22	17.93	-	0.54
S-I47	UNT to Gauley River	Nicholas	Huntington	Panther Creek-Gauley River	Intermittent	Pipeline ROW	0.658	80	52.64	-	1.58

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S-I48	UNT to Gauley River	Nicholas	Huntington	Panther Creek-Gauley River	Perennial	Pipeline ROW	0.803	22	17.67	-	0.53
S-J28	UNT to Little Laurel Creek	Nicholas	Huntington	Panther Creek-Gauley River	Intermittent	Pipeline ROW	0.711	79	56.17	-	1.69
S-J25	UNT to Little Laurel Creek	Nicholas	Huntington	Panther Creek-Gauley River	Ephemeral	Pipeline ROW	0.863	77	66.45	-	1.99
S-J24 (1)	UNT to Little Laurel Creek (1)	Nicholas	Huntington	Panther Creek-Gauley River	Perennial	Pipeline ROW	0.770	76	58.52	-	1.76
S-J24 (2)	UNT to Little Laurel Creek (2)	Nicholas	Huntington	Panther Creek-Gauley River	Perennial	Pipeline ROW	0.858	76	65.21	-	1.96
S-J23-EPH	UNT to Little Laurel Creek	Nicholas	Huntington	Panther Creek-Gauley River	Ephemeral	Pipeline ROW	0.525	109	57.23	-	1.72
S-J22	UNT to Little Laurel Creek	Nicholas	Huntington	Panther Creek-Gauley River	Intermittent	Pipeline ROW	0.587	85	49.90	-	1.50
S-N10	Skelt Run	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.633	78	49.37	-	1.48
S-N10-Braid	Skelt Run	Nicholas	Huntington	Outlet Hominy Creek	Intermittent	Pipeline ROW	0.448	101	45.25	-	1.36
S-EE1	UNT to Skelt Run	Nicholas	Huntington	Outlet Hominy Creek	Ephemeral	Pipeline ROW	0.540	22	11.88	-	0.36
S-N13-Braid	UNT to Skelt Run	Nicholas	Huntington	Outlet Hominy Creek	Intermittent	Pipeline ROW	0.439	37	16.24	-	0.49
S-N13[1]	UNT to Skelt Run	Nicholas	Huntington	Outlet Hominy Creek	Intermittent	Pipeline ROW	0.439	89	39.07	-	1.17
S-L41	Jims Creek	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.831	76	63.16	-	1.89
S-L38	UNT to Riley Branch	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.725	75	54.38	-	1.63
S-L35 TEMP AR	Riley Branch TEMP AR	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Temporary Access Road	0.790	52	41.08	2.46	-
S-L35 (1)	Riley Branch (1)	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.683	86	58.74	-	1.76
S-L35 (2)	Riley Branch (2)	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.710	87	61.77	-	1.85
S-L35 (3)	Riley Branch (3)	Nicholas	Huntington	Outlet Hominy Creek	Perennial	Pipeline ROW	0.773	79	61.07	-	1.83
S-I37[1]	UNT to Hominy Creek[1]	Nicholas	Huntington	Headwaters Hominy Creek	Ephemeral	Pipeline ROW	0.485	40	19.40	-	0.58
S-I38	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.598	77	46.05	-	1.38
S-I39	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.574	79	45.35	-	1.36
S-I40	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.650	82	53.30	-	1.60
S-I41[1]	UNT to Hominy Creek[1]	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.574	78	44.77	-	1.34
S-I36	Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Pipeline ROW	0.878	77	67.61	-	2.03
S-I31	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Ephemeral	Pipeline ROW	0.485	73	35.41	-	1.06
S-N8a	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Timber Mat Crossing	0.671	22	14.76	0.89	-
S-VV1	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Timber Mat Crossing	0.684	22	15.05	0.90	-
S-H88	Sugar Branch	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Pipeline ROW	0.685	76	52.06	-	1.56
S-H71	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Pipeline ROW	0.710	93	66.03	-	1.98
S-H67	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Pipeline ROW	0.623	85	52.96	-	1.59
S-H64	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.449	87	39.06	-	1.17
S-V3	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Perennial	Pipeline ROW	0.829	22	18.24	-	0.55
S-EF41	UNT to Hominy Creek	Nicholas	Huntington	Headwaters Hominy Creek	Intermittent	Pipeline ROW	0.595	82	48.79	-	1.46
S-J19	UNT to Meadow Creek	Greenbrier	Huntington	Meadow Creek-Meadow River	Ephemeral	Timber Mat Crossing	0.445	22	9.79	0.59	-
S-J20	UNT to Meadow Creek	Greenbrier	Huntington	Meadow Creek-Meadow River	Perennial	Pipeline ROW	0.578	22	12.72	-	0.38
S-I25	UNT to Meadow Creek	Greenbrier	Huntington	Meadow Creek-Meadow River	Intermittent	Pipeline ROW	0.477	75	35.78	-	1.07
S-I26	UNT to Meadow Creek	Greenbrier	Huntington	Meadow Creek-Meadow River	Intermittent	Pipeline ROW	0.442	78	34.48	-	1.03
S-I27	UNT to Meadow Creek	Greenbrier	Huntington	Meadow Creek-Meadow River	Intermittent	Pipeline ROW	0.444	22	9.77	-	0.29

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S-L26 (2)	UNT to Meadow River (2)	Greenbrier	Huntington	Meadow Creek-Meadow River	Perennial	Pipeline ROW	0.730	166	121.18	-	3.64
S-EF38	UNT to Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Intermittent	Timber Mat Crossing	0.315	22	6.93	0.42	-
S-L24	UNT to Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Intermittent	Timber Mat Crossing	0.390	22	8.58	0.51	-
S-L27	UNT to Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.648	22	14.26	-	0.43
S-L30	UNT to Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Intermittent	Pipeline ROW	0.446	136	60.66	-	1.82
S-L22	Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.740	75	55.50	-	1.67
S-L20	UNT to Little Sewell Creek	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.713	96	68.45	-	2.05
S-L10	UNT to Boggs Creek	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.655	103	67.47	-	2.02
S-L11	UNT to Boggs Creek	Greenbrier	Huntington	Sewell Creek	Intermittent	Pipeline ROW	0.435	26	11.31	-	0.34
S-I21 (1)	UNT to Boggs Creek (1)	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.932	30	27.96	-	0.84
S-I21 (2)	UNT to Boggs Creek (2)	Greenbrier	Huntington	Sewell Creek	Perennial	Pipeline ROW	0.850	77	65.45	-	1.96
S-I22	UNT to Boggs Creek	Greenbrier	Huntington	Sewell Creek	Intermittent	Pipeline ROW	0.588	94	55.27	-	1.66
S-HH8[1]	UNT to Buffalo Creek[1]	Greenbrier	Huntington	Otter Creek-Meadow River	Ephemeral	ATWS	0.708	15	10.62	0.64	-
S-K25/K18[1]	UNT to Buffalo Creek[1]	Greenbrier	Huntington	Otter Creek-Meadow River	Intermittent	ATWS	0.708	70	49.56	-	1.49
S-K17	Buffalo Creek	Greenbrier	Huntington	Otter Creek-Meadow River	Perennial	Pipeline ROW	0.815	75	61.13	-	1.83
S-K19	UNT to Buffalo Creek	Greenbrier	Huntington	Otter Creek-Meadow River	Intermittent	Pipeline ROW	0.708	93	65.84	-	1.98
S-K21	UNT to Buffalo Creek	Greenbrier	Huntington	Otter Creek-Meadow River	Perennial	Pipeline ROW	0.658	82	53.96	-	1.62
S-K22	UNT to Buffalo Creek	Greenbrier	Huntington	Otter Creek-Meadow River	Perennial	Pipeline ROW	0.610	78	47.58	-	1.43
S-UV6	UNT to Morris Fork	Greenbrier	Huntington	Otter Creek-Meadow River	Perennial	Pipeline ROW	0.723	88	63.62	-	1.91
S-UV2 ROW	Morris Fork ROW	Greenbrier	Huntington	Otter Creek-Meadow River	Perennial	Pipeline ROW	0.735	88	64.68	-	1.94
S-U22	UNT to Meadow River	Greenbrier	Huntington	Otter Creek-Meadow River	Intermittent	Pipeline ROW	0.480	80	38.40	-	1.15
S-FF1	UNT to Meadow River	Greenbrier	Huntington	Otter Creek-Meadow River	Ephemeral	Permanent Access Road	0.523	11	5.75	-	0.17
S-EE4	UNT to Red Spring Branch	Summers	Huntington	Lick Creek	Intermittent	Pipeline ROW	0.594	137	81.38	-	2.44
S-M6	UNT to Red Spring Branch	Summers	Huntington	Lick Creek	Intermittent	Pipeline ROW	0.520	110	57.20	-	1.72
S-J13 (1)	UNT to Patterson Creek (1)	Summers	Huntington	Otter Creek-Meadow River	Ephemeral	Pipeline ROW	0.661	92	60.81	-	1.82
S-J13 (2)	UNT to Patterson Creek (2)	Summers	Huntington	Otter Creek-Meadow River	Ephemeral	Pipeline ROW	0.616	96	59.14	-	1.77
S-J13 (3)	UNT to Patterson Creek (3)	Summers	Huntington	Otter Creek-Meadow River	Ephemeral	Pipeline ROW	0.603	124	74.77	-	2.24
S-M5	Red Spring Branch	Summers	Huntington	Lick Creek	Ephemeral	Timber Mat Crossing	0.667	22	14.67	0.88	-
S-M4	UNT to Red Spring Branch	Summers	Huntington	Lick Creek	Ephemeral	Temporary Access Road	0.588	47	27.64	1.66	-
S-I13	UNT to Lick Creek	Summers	Huntington	Lick Creek	Intermittent	Timber Mat Crossing	0.708	22	15.58	0.93	-
S-I14	UNT to Lick Creek	Summers	Huntington	Lick Creek	Intermittent	Timber Mat Crossing	0.529	22	11.64	0.70	-
S-I15	UNT to Lick Creek	Summers	Huntington	Lick Creek	Intermittent	Timber Mat Crossing	0.610	22	13.42	0.81	-
S-I16	UNT to Lick Creek	Summers	Huntington	Lick Creek	Intermittent	Timber Mat Crossing	0.488	22	10.74	0.64	-

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S-I17	UNT to Lick Creek	Summers	Huntington	Lick Creek	Ephemeral	Pipeline ROW	0.775	78	60.45	-	1.81
S-I19	Lick Creek	Summers	Huntington	Lick Creek	Perennial	Pipeline ROW	0.835	77	64.30	-	1.93
S-I20	UNT to Lick Creek	Summers	Huntington	Lick Creek	Perennial	Pipeline ROW	0.600	92	55.20	-	1.66
S-N5	UNT to Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.548	87	47.68	-	
S-K14	UNT to Righthand Fork Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Pipeline ROW	0.528	97	51.22	-	1.54
S-N3	UNT to Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Pipeline ROW	0.625	22	13.75	-	0.41
S-N2	Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.795	22	17.49	-	0.52
S-CD23[1]	UNT to Hungard Creek[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Pipeline ROW	0.792	22	17.42	-	0.52
S-N4	UNT to Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Pipeline ROW	0.792	22	17.42	-	0.52
S-M3	Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.753	80	60.24	-	1.81
S-KL29	Right Fork Hungard Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.595	75	44.63	-	1.34
S-CV17	UNT to Greenbrier River	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Pipeline ROW	0.829	76	63.00	-	1.89
S-EF53[1]	UNT to Greenbrier River[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Temporary Access Road	0.563	51	28.71	-	0.86
S-I9[1]	UNT to Greenbrier River[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Pipeline ROW	0.563	22	12.39	-	0.37
S-K10 (1)[1]	UNT to Greenbrier River (1)[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Temporary Access Road	0.563	9	5.07	-	0.15
S-K10 (3)[1]	UNT to Greenbrier River (3)[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Temporary Access Road	0.563	9	5.07	-	0.15
S-L4	UNT to Greenbrier River	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.485	77	37.35	-	1.12
S-L2	UNT to Greenbrier River	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Pipeline ROW	0.563	88	49.54	-	1.49
S-L1	UNT to Kelly Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.568	76	43.17	-	1.30
S-J5	Kelly Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Perennial	Pipeline ROW	0.450	103	46.35	-	1.39
S-J4	UNT to Keller Creek	Summers	Huntington	Hungard Creek-Greenbrier River	Intermittent	Pipeline ROW	0.399	22	8.78	-	0.26
S-G47[1]	UNT to Wind Creek[1]	Summers	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Timber Mat Crossing	0.625	22	13.75	0.83	-
S-G52[1]	UNT to Wind Creek[1]	Monroe	Huntington	Hungard Creek-Greenbrier River	Ephemeral	Timber Mat Crossing	0.625	22	13.75	0.83	-
S-G49	UNT to Wind Creek	Monroe	Huntington	Hungard Creek-Greenbrier River	Perennial	Timber Mat Crossing	0.625	22	13.75	0.83	-
S-G48	Wind Creek	Monroe	Huntington	Hungard Creek-Greenbrier River	Perennial	Timber Mat Crossing	0.853	22	18.77	1.13	-
S-H61	UNT to Stoney Creek	Monroe	Huntington	Stony Creek-Greenbrier River	Perennial	Timber Mat Crossing	0.817	22	17.97	1.08	-
S-OP1	Stony Creek	Monroe	Huntington	Stony Creek-Greenbrier River	Perennial	Pipeline ROW	0.665	78	51.87	-	1.56
S-IJ64	UNT to Little Stony Creek	Monroe	Huntington	Stony Creek-Greenbrier River	Ephemeral	Timber Mat Crossing	0.511	22	11.24	0.67	-
S-A63 ROW	Slate Run ROW	Monroe	Huntington	Middle Indian Creek	Perennial	Pipeline ROW	0.570	88	50.16	-	1.50
S-A61(1)[1]	UNT to Slate Run(1)[1]	Monroe	Huntington	Middle Indian Creek	Ephemeral	Temporary Access Road	0.481	8	3.85	-	0.12
S-A61(2)[1]	UNT to Slate Run(2)[1]	Monroe	Huntington	Middle Indian Creek	Ephemeral	Temporary Access Road	0.481	8	3.85	-	0.12
S-A61 ROW	UNT to Slate Run ROW	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.481	81	38.96	-	1.17
S-A60	Slate Run	Monroe	Huntington	Middle Indian Creek	Perennial	Pipeline ROW	0.628	87	54.64	-	1.64
S-D31	Indian Creek	Monroe	Huntington	Middle Indian Creek	Perennial	Pipeline ROW	0.583	75	43.73	-	1.31
S-D29[1]	UNT to Hans Creek[1]	Monroe	Huntington	Middle Indian Creek	Intermittent	Timber Mat Crossing	0.624	4	2.50	-	0.07
S-D25	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Intermittent	Pipeline ROW	0.624	22	13.73	-	0.41
S-F18 TM	UNT to Hans Creek TM	Monroe	Huntington	Middle Indian Creek	Perennial	Timber Mat Crossing	0.633	22	13.93	0.84	-
S-Z5	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.418	75	31.35	-	0.94
S-Z4	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.613	75	45.98	-	1.38
S-MN2	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Perennial	Pipeline ROW	0.720	81	58.32	-	1.75
S-CV19	Hans Creek	Monroe	Huntington	Middle Indian Creek	Perennial	Pipeline ROW	0.820	77	63.14	-	1.89

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S-MN39[1]	UNT to Blue Lick Creek[1]	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.586	22	12.89	-	0.39
S-MN38	UNT to Blue Lick Creek	Monroe	Huntington	Middle Indian Creek	Intermittent	Pipeline ROW	0.553	22	12.17	-	0.36
S-MN37	UNT to Blue Lick Creek	Monroe	Huntington	Middle Indian Creek	Intermittent	Pipeline ROW	0.586	95	55.67	-	1.67
S-MN40[1]	UNT to Blue Lick Creek[1]	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.586	37	21.68	-	0.65
S-G44	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.587	86	50.48	-	1.51
S-G43	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.754	22	16.59	-	0.50
S-G42	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Intermittent	Pipeline ROW	0.558	79	44.08	-	1.32
S-MN45	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Ephemeral	Pipeline ROW	0.600	87	52.20	-	1.57
S-CV27	UNT to Hans Creek	Monroe	Huntington	Middle Indian Creek	Intermittent	Pipeline ROW	0.590	37	21.83	-	0.65
S-E43	UNT to Dry Creek	Monroe	Huntington	Rich Creek	Ephemeral	Pipeline ROW	0.530	92	48.76	-	1.46
S-E45	UNT to Dry Creek	Monroe	Huntington	Rich Creek	Ephemeral	Pipeline ROW	0.648	108	69.98	-	2.10
S-E40 TEMP AR	Dry Creek TEMP AR	Monroe	Huntington	Rich Creek	Perennial	Temporary Access Road	0.693	43	29.80	1.79	-
S-E40 ROW	Dry Creek ROW	Monroe	Huntington	Rich Creek	Perennial	Pipeline ROW	0.739	82	60.60	-	1.82
S-E41	UNT to Dry Creek	Monroe	Huntington	Rich Creek	Intermittent	Pipeline ROW	0.523	23	12.03	-	0.36
S-C38	UNT to Painter Run	Monroe	Huntington	Rich Creek	Intermittent	Pipeline ROW	0.643	89	57.23	-	1.72
S-C39	Painter Run	Monroe	Huntington	Rich Creek	Perennial	Pipeline ROW	0.853	109	92.98	-	2.79
S-C41	UNT to Painter Run	Monroe	Huntington	Rich Creek	Intermittent	Pipeline ROW	0.606	143	86.66	-	2.60
S-C40[1]	UNT to Painter Run[1]	Monroe	Huntington	Rich Creek	Perennial	Temporary Access Road	0.606	77	46.66	2.80	
S-Q13	Kimballton Branch	Giles	Norfolk	Stony Creek	Perennial	Pipeline ROW	1.50	90	135	-	4.05
S-Q12	UNT to Kimballton Branch	Giles	Norfolk	Stony Creek	Ephemeral	Pipeline ROW	0.75	86	65	-	1.95
S-P6	UNT to Stony Creek	Giles	Norfolk	Stony Creek	Ephemeral	Pipeline ROW	0.75	78	59	-	1.77
S-S5	Stony Creek	Giles	Norfolk	Stony Creek	Perennial	Timber Mat Crossing	1.42	40	57	-	1.71
S-S5-Braid-1	Stony Creek	Giles	Norfolk	Stony Creek	Ephemeral	Timber Mat Crossing	0.45	20	9	-	0.27
S-S5-Braid-2	Stony Creek	Giles	Norfolk	Stony Creek	Ephemeral	Timber Mat Crossing	0.45	20	9	-	0.27
S-G30	UNT to Dry Branch	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.35	85	30	-	0.90
S-G29	UNT to Dry Branch	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.38	30	11	-	0.33
S-G32	Dry Branch	Giles	Norfolk	Little Stony Creek-New River	Intermittent	Pipeline ROW	1.05	110	116	-	3.48
S-G33	UNT to Dry Branch	Giles	Norfolk	Little Stony Creek-New River	Perennial	Pipeline ROW	0.89	99	88	-	2.64
S-G35	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Timber Mat Crossing	1.33	25	33	1.98	-
S-G35	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Pipeline ROW	1.30	25	33	-	0.99
S-SS4	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.34	20	7	-	0.21
S-Z9	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Pipeline ROW	1.32	20	26	-	0.78
S-Z7-Braid-1	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.35	20	7	-	0.21
S-Z7	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Intermittent	Pipeline ROW	1.27	20	25	-	0.75
S-Z10	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Intermittent	Timber Mat Crossing	1.30	20	26	-	0.78
S-Z13	Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Timber Mat Crossing	1.39	25	35	-	1.05
S-Z12-EPH	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Timber Mat Crossing	0.45	20	9	-	0.27
S-Z11	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Timber Mat Crossing	1.31	20	26	-	0.78
S-Z14	UNT to Little Stony Creek	Giles	Norfolk	Little Stony Creek-New River	Intermittent	Timber Mat Crossing	1.20	20	24	-	0.72
S-YZ1 (North)	Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Intermittent	Temporary Access Road	1.32	102	135	-	4.05
S-A33	UNT to Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.40	111	44	-	1.32
S-A34	UNT to Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Pipeline ROW	0.37	86	32	-	0.96
S-A32	UNT to Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Pipeline ROW	1.22	78	95	-	2.85
S-Y2	Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Perennial	Timber Mat Crossing	1.22	25	31	-	0.93

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S-Y3	UNT to Doe Creek	Giles	Norfolk	Little Stony Creek-New River	Ephemeral	Timber Mat Crossing	0.39	20	8	-	0.24
S-E25-Downstream S	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Timber Mat Crossing	1.29	20	26	1.56	-
S-E25-Upstream	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Pipeline ROW	1.37	15	21	-	0.63
S-E25-Downstream N	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Timber Mat Crossing	1.19	20	24	-	0.72
S-E24	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Pipeline ROW	1.27	81	103	-	3.09
S-MN11-Downstream	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.27	37	10	0.60	-
S-MN11-Upstream	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.27	30	8	0.48	-
S-MN11-Upstream	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.27	15	4	0.24	-
S-RR5	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Pipeline ROW	1.19	83	99	-	2.97
S-RR4	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Temporary Access Road	1.20	85	102	6.12	-
S-PA07	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Intermittent	Pipeline ROW	1.24	115	143	-	4.29
S-IJ18-INT	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Intermittent	Temporary Access Road	1.38	44	61	3.66	-
S-IJ19	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.26	9	2	0.12	-
S-IJ19	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.40	43	17	1.02	-
S-IJ18-EPH	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Pipeline ROW	0.39	74	29	-	0.87
S-IJ16-b	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Pipeline ROW	0.40	78	31	-	0.93
S-IJ17	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Pipeline ROW	0.39	31	12	-	0.36
S-IJ16-a (TEMP)	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Permanent Access Road	0.41	20	8	0.48	-
S-QQ3	UNT to Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Ephemeral	Temporary Access Road	0.30	15	5	-	0.15
S-NN17	Sinking Creek	Giles	Norfolk	Lower Sinking Creek	Perennial	Timber Mat Crossing	1.20	55	66	-	1.98
S-RR2	Greenbriar Branch	Giles	Norfolk	Upper Sinking Creek	Perennial	Timber Mat Crossing	1.23	20	25	-	0.75
S-MM18	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Ephemeral	Pipeline ROW	0.43	88	38	-	1.14
S-MM17	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Perennial	Temporary Access Road	1.07	49	52	3.12	-
S-NN12	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Ephemeral	Pipeline ROW	0.44	88	39	-	1.17
S-NN11	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Intermittent	Pipeline ROW	1.23	84	103	-	3.09
S-KL43	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Perennial	Pipeline ROW	1.33	75	100	-	3.00
S-OO14	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Perennial	Pipeline ROW	1.18	86	101	-	3.03
S-OO13	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Perennial	Pipeline ROW	1.29	77	99	-	2.97
S-OO12	UNT to Sinking Creek	Giles	Norfolk	Upper Sinking Creek	Ephemeral	Pipeline ROW	0.41	25	10	-	0.30
S-PP1	UNT to Sinking Creek	Craig	Norfolk	Upper Sinking Creek	Intermittent	Pipeline ROW	0.96	86	83	-	2.49
S-PP3	UNT to Sinking Creek	Craig	Norfolk	Upper Sinking Creek	Perennial	Pipeline ROW	0.54	82	44	-	1.32
S-QQ2	Sinking Creek	Craig	Norfolk	Upper Sinking Creek	Perennial	Temporary Access Road	1.36	40	54	3.24	-
S-PP4	UNT to Sinking Creek	Craig	Norfolk	Upper Sinking Creek	Intermittent	Pipeline ROW	1.10	84	92	-	2.76
S-PP22	UNT to Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Intermittent	Pipeline ROW	1.28	44	56	-	1.68
S-PP21	UNT to Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Perennial	Pipeline ROW	1.16	20	23	-	0.69
S-PP20	UNT to Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Perennial	Pipeline ROW	1.27	20	25	-	0.75
S-OO6	Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Perennial	Timber Mat Crossing	1.24	35	43	-	1.29
S-RR14	UNT to Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Ephemeral	Pipeline ROW	0.38	20	8	-	0.24
S-RR13	Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Perennial	Temporary Access Road	1.35	41	55	3.30	-
S-HH18	UNT to Craig Creek	Montgomery	Norfolk	Trout Creek-Craig Creek	Perennial	Timber Mat Crossing	1.10	20	22	-	0.66
S-MN21	UNT to Mill Creek	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Perennial	Pipeline ROW	1.20	80	96	-	2.88
S-MN22	UNT to Mill Creek	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.38	96	36	-	1.08
S-EF65	Mill Creek	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Intermittent	Pipeline ROW	1.13	152	172	-	5.16
S-EF62	UNT to Mill Creek	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Perennial	Pipeline ROW	1.27	76	97	-	2.91

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S-IJ52	UNT to Mill Creek	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Perennial	Pipeline ROW	1.16	84	97	-	2.91
S-G36	North Fork Roanoke River	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Perennial	Temporary Access Road	1.38	26	36	2.16	-
S-G38	IT to North Fork RoanokeRive	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Ephemeral	Timber Mat Crossing	0.37	20	7	0.42	-
S-G39	IT to North Fork RoanokeRive	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Intermittent	Pipeline ROW	1.17	82	96	-	2.88
S-PP23	IT to North Fork RoanokeRive	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Ephemeral	Timber Mat Crossing	0.39	20	8	0.48	-
S-G40	IT to North Fork RoanokeRive	Montgomery	Norfolk	Dry Run-North Fork Roanoke River	Perennial	Timber Mat Crossing	1.18	20	24	1.44	-
S-MM15	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.14	82	93	-	2.79
S-MM14	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.36	105	38	-	1.14
S-MM13	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.33	85	28	-	0.84
S-MM11	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.36	80	29	-	0.87
S-F15	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.32	129	170	-	5.10
S-F16a/F16b	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.37	81	30	-	0.90
S-C36 (US)	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.22	36	117	-	3.51
S-C36	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.13	96	41	-	1.23
S-MM31	UNT to Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.38	20	8	-	0.24
S-C29	Flatwoods Branch	Montgomery	Norfolk	Wilson Creek-North Fork Roanoke River	Ephemeral	Pipeline ROW	0.33	46	15	-	0.45
S-C24	UNT to Bradshaw Creek	Montgomery	Norfolk	Bradshaw Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.17	108	126	-	3.78
S-C25	UNT to Bradshaw Creek	Montgomery	Norfolk	Bradshaw Creek-North Fork Roanoke River	Intermittent	Pipeline ROW	1.11	115	128	-	3.84
S-C21	Bradshaw Creek	Montgomery	Norfolk	Bradshaw Creek-North Fork Roanoke River	Perennial	Pipeline ROW	1.21	25	31	-	0.93
S-NN19	UNT to Roanoke River	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Intermittent	Pipeline ROW	1.18	76	90	-	2.70
S-I1	UNT to Roanoke River	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Intermittent	Timber Mat Crossing	1.02	20	20	-	0.60
S-AB16	UNT to Roanoke River	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Intermittent	Timber Mat Crossing	1.14	20	23	-	0.69
S-CD12b	NT to South Fork Roanoke Riv	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Perennial	Pipeline ROW	1.11	20	22	-	0.66
S-EF19	UNT to Indian Run	Montgomery	Norfolk	Brake Branch-South Fork Roanoke River	Ephemeral	Pipeline ROW	0.34	79	27	-	0.81
S-EF20a	UNT to Roanoke River	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Perennial	Pipeline ROW	1.27	80	102	-	3.06
S-MM22	UNT to Roanoke River	Montgomery	Norfolk	Sawmill Hollow-Roanoke River	Perennial	Pipeline ROW	1.50	175	263	-	7.89
S-IJ50	UNT to Roanoke River	Roanoke	Norfolk	Sawmill Hollow-Roanoke River	Perennial	Pipeline ROW	1.37	77	105	-	3.15
S-Y13	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.09	85	93	-	2.79
S-Y14	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Pipeline ROW	1.22	77	94	-	2.82
S-EF34b	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Pipeline ROW	1.36	81	110	-	3.30
S-EF55	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.28	33	42	-	1.26
S-EF57	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Temporary Access Road	1.48	42	62	-	1.86
S-EF33	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.14	148	169	-	5.07
S-IJ82	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.10	20	22	-	0.66
S-IJ83	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Timber Mat Crossing	1.41	148	209	-	6.27
S-IJ85	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Temporary Access Road	1.50	50	75	-	2.25
S-IJ84	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.33	35	47	-	1.41
S-IJ88	Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.49	30	45	-	1.35
S-IJ90	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Timber Mat Crossing	1.50	20	30	-	0.90
S-IJ89	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.50	20	30	-	0.90
S-KL25	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.50	82	123	-	3.69
S-ST9b	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.34	20	27	-	0.81
S-KL55	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Pipeline ROW	1.26	20	25	-	0.75
S-IJ12	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Pipeline ROW	1.11	20	22	-	0.66

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S-EF44	UNT to Bottom Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Pipeline ROW	1.21	20	24	-	0.72
S-IJ43	Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.33	20	27	-	0.81
S-Y8	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.24	20	25	-	0.75
S-Y7	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Timber Mat Crossing	1.16	32	37	-	1.11
S-B22	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Timber Mat Crossing	1.19	20	24	-	0.72
S-B25	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Timber Mat Crossing	1.23	76	93	-	2.79
S-B23	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Intermittent	Timber Mat Crossing	1.24	14	17	-	0.51
S-B21	UNT to Mill Creek	Roanoke	Norfolk	Bottom Creek	Perennial	Pipeline ROW	1.28	92	118	-	3.54
S-G25	UNT to Green Creek	Franklin	Norfolk	South Fork Blackwater River	Intermittent	Pipeline ROW	1.18	42	50	-	1.50
S-G24	UNT to Green Creek	Franklin	Norfolk	South Fork Blackwater River	Intermittent	Pipeline ROW	1.26	75	95	-	2.85
S-H1	Green Creek	Franklin	Norfolk	South Fork Blackwater River	Perennial	Timber Mat Crossing	1.28	20	26	1.56	-
S-RR18	UNT to Green Creek	Franklin	Norfolk	South Fork Blackwater River	Intermittent	Permanent Access Road	1.24	8	10	0.60	-
S-G27	UNT to Green Creek	Franklin	Norfolk	South Fork Blackwater River	Perennial	Timber Mat Crossing	1.36	20	27	1.62	-
S-G26	UNT to Green Creek	Franklin	Norfolk	South Fork Blackwater River	Intermittent	Timber Mat Crossing	1.35	20	27	1.62	-
S-D14	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	0.85	234	199	-	5.97
S-D13	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	0.94	117	110	-	3.30
S-D12	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	1.10	54	59	-	1.77
S-D11	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Pipeline ROW	1.35	20	27	-	0.81
S-D8	North Fork Blackwater River	Franklin	Norfolk	North Fork Blackwater River	Perennial	Pipeline ROW	1.35	78	105	-	3.15
S-II4	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Timber Mat Crossing	1.19	20	24	1.44	-
S-GH7	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Timber Mat Crossing	1.21	20	24	1.44	-
S-GH15	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	1.11	75	83	-	2.49
S-GH14	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Pipeline ROW	1.16	76	88	-	2.64
S-GH9	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Pipeline ROW	1.07	78	83	-	2.49
S-GH11	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	1.12	77	86	-	2.58
S-RR08	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Ephemeral	Pipeline ROW	0.41	20	8	-	0.24
S-RR09	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Ephemeral	Pipeline ROW	0.39	77	30	-	0.90
S-RR11	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Ephemeral	Pipeline ROW	0.40	77	31	-	0.93
S-IJ1	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Pipeline ROW	1.25	107	134	-	4.02
S-IJ3	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Timber Mat Crossing	1.18	21	91	5.46	-
S-IJ2	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Intermittent	Pipeline ROW	1.06	40	42	-	1.26
S-IJ4	T to North Fork Blackwater R	Franklin	Norfolk	North Fork Blackwater River	Perennial	Timber Mat Crossing	1.22	20	24	1.44	-
S-IJ10	Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.07	20	21	-	0.63
S-KL2	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.10	20	22	1.32	-
S-II8	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Timber Mat Crossing	0.74	20	46	2.76	-
S-II7	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Timber Mat Crossing	1.14	20	23	1.38	-
S-II9	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.16	20	23	1.38	-
S-II11	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.10	20	22	1.32	-
S-II12	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Timber Mat Crossing	1.03	20	21	1.26	-
S-GH6	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.09	20	22	1.32	-
S-II6	UNT to Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Timber Mat Crossing	0.66	20	46	2.76	-
S-E28 - West	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.26	82	103	-	3.09
S-GH3	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.16	20	23	-	0.69
S-GH4	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	1.22	20	24	-	0.72

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S-GH2	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Timber Mat Crossing	0.74	20	15	0.90	-
S-E29	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.26	80	101	-	3.03
S-E28 - Mid	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.24	76	94	-	2.82
S-E28 - East	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.20	101	121	-	3.63
S-EF4	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.36	80	109	-	3.27
S-EF7 - atws	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	ATWS	0.46	22	10	-	0.30
S-EF7	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Timber Mat Crossing	0.42	20	8	-	0.24
S-EF12	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.32	79	104	-	3.12
S-MM42	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Pipeline ROW	0.38	81	31	-	0.93
S-RR15	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.24	20	25	-	0.75
S-D23	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.12	92	103	-	3.09
S-D22	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Pipeline ROW	1	83	83	-	2.49
S-D20	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Pipeline ROW	0.96	76	73	-	2.19
S-D18	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Pipeline ROW	0.4	30	12	-	0.36
S-C14	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.35	90	122	-	3.66
S-C16	UNT to Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Timber Mat Crossing	0.95	20	19	1.14	-
S-C17	Teels Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.34	30	40	-	1.20
S-CD6	Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.26	77	97	-	2.91
S-II2	Little Creek	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.33	76	101	-	3.03
S-CD1	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.11	104	115	-	3.45
S-KL35	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.32	35	46	-	1.38
S-KL36	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.32	20	46	-	1.38
S-KL38	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.03	78	80	-	2.40
S-KL39	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.07	121	88	-	2.64
S-YZ5	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Pipeline ROW	0.43	86	37	-	1.11
S-YZ4	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Pipeline ROW	0.43	84	36	-	1.08
S-EF48	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Pipeline ROW	0.93	86	80	-	2.40
S-KL41	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.15	75	86	-	2.58
S-C8	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Intermittent	Pipeline ROW	0.93	86	80	-	2.40
S-F4	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Ephemeral	Pipeline ROW	0.62	82	51	-	1.53
S-KL51	UNT to Blackwater River	Franklin	Norfolk	Madcap Creek-Blackwater River	Perennial	Pipeline ROW	1.15	67	77	-	2.31
S-KL52	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Ephemeral	Pipeline ROW	0.37	105	39	-	1.17
S-KL54	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Perennial	Pipeline ROW	1.07	76	86	-	2.58
S-F8	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Perennial	Pipeline ROW	1.07	83	89	-	2.67
S-S11	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Perennial	Temporary Access Road	1.50	41	62	3.72	-
S-HH4	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Intermittent	Pipeline ROW	1.10	97	107	-	3.21
S-C20	UNT to Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Ephemeral	Timber Mat Crossing	0.29	20	6	-	0.18
S-C19	Maggodee Creek	Franklin	Norfolk	Maggodee Creek	Perennial	Pipeline ROW	1.04	75	78	-	2.34
S-F11	Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.11	91	101	-	3.03
S-MM23	Maple Branch	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Temporary Access Road	1.21	78	94	5.64	-
S-MM29	UNT to Maple Branch	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Temporary Access Road	1.33	42	56	3.36	-
S-F9b	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.36	76	103	-	3.09
S-F9a	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.01	20	20	-	0.60
S-F10	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Ephemeral	Pipeline ROW	0.42	20	8	-	0.24

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S-GG4	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Ephemeral	Pipeline ROW	0.37	20	7	-	0.21
S-A36	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Ephemeral	Pipeline ROW	0.36	77	28	-	0.84
S-A40	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Timber Mat Crossing	1.09	13	14	-	0.42
S-A38	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.09	30	33	-	0.99
S-A41	Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.02	76	78	-	2.34
S-GH37	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	0.93	46	43	-	1.29
S-KL17	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.24	20	25	-	0.75
S-GH36	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.06	20	21	-	0.63
S-GH39	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	0.93	103	96	-	2.88
S-GH38	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.00	7	7	-	0.21
S-GH40	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Ephemeral	Pipeline ROW	0.43	89	38	-	1.14
S-GH44	UNT to Foul Ground Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.15	103	219	-	6.57
S-G21	UNT to Poplar Camp Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	1.03	54	55	-	1.65
S-G23	UNT to Poplar Camp Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	0.95	42	40	-	1.20
S-G22	UNT to Poplar Camp Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.07	80	86	-	2.58
S-G20	Poplar Camp Creek	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Timber Mat Crossing	0.99	20	20	-	0.60
S-G18	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Intermittent	Pipeline ROW	0.85	81	69	-	2.07
S-G17	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Ephemeral	Timber Mat Crossing	0.33	20	7	0.42	-
S-E18	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	0.92	94	86	-	2.58
S-E17	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1.13	95	107	-	3.21
S-E14	UNT to Blackwater River	Franklin	Norfolk	Standiford Creek-Smith Mountain Lake	Perennial	Pipeline ROW	1..15	82	94	-	2.82
S-H38	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.10	20	22	-	0.66
S-H37	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.28	82	23	-	0.69
S-H36	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.17	20	23	-	0.69
S-H34	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.09	20	22	-	0.66
S-H32	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.27	20	25	-	0.75
S-H30	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	0.87	4	3	-	0.09
S-A18	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	0.96	87	84	-	2.52
S-A20	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	0.81	20	16	-	0.48
S-A19/H26	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	0.77	212	163	-	4.89
S-A22	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	0.89	20	18	-	0.54
S-H27	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.42	36	15	-	0.45
S-H28	UNT to Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.43	16	7	-	0.21
S-MM45	UNT to Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Timber Mat Crossing	0.43	33	14	-	0.42
S-MM46	UNT to Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Timber Mat Crossing	1.50	9	14	-	0.42
S-MM44	UNT to Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.08	20	22	-	0.66
S-MM48	UNT to Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.09	25	27	-	0.81
S-H25	Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.13	20	23	-	0.69
S-H24	UNT to Little Jacks Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.05	20	21	-	0.63
S-H23	UNT to Turkey Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.43	92	40	-	1.20
S-HH1	UNT to Turkey Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.43	18	8	-	0.24
S-A13	Turkey Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.09	20	22	-	0.66
S-A11	UNT to Turkey Creek	Franklin	Norfolk	Owens Creek-Pigg River	Ephemeral	Pipeline ROW	0.40	55	22	-	0.66
S-H17	Dinner Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	1.27	101	128	-	3.84

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S-A7	UNT to Dinner Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.00	20	20	-	0.60
S-SS8	Polecat Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.41	20	28	-	0.84
S-CD8	UNT to Owens Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	1.23	78	96	-	2.88
S-AB8	UNT to Owens Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	1.10	84	92	-	2.76
S-DD3	Owens Creek	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	1.25	20	25	-	0.75
S-G16	Strawfield Creek	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.25	30	38	-	1.14
S-G15	UNT to Parrot Branch	Franklin	Norfolk	Owens Creek-Pigg River	Intermittent	Pipeline ROW	1.17	88	103	-	3.09
S-G13	Parrot Branch	Franklin	Norfolk	Owens Creek-Pigg River	Perennial	Pipeline ROW	1.33	20	27	-	0.81
S-D7	UNT to Jonnikin Creek	Franklin	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	0.70	80	56	-	1.68
S-D4	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	1.25	105	131	-	3.93
S-D3	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.31	20	26	-	0.78
S-D2	Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.25	20	25	-	0.75
S-D1-INT	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	1.24	29	36	-	1.08
S-D1-EPH	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Ephemeral	Pipeline ROW	0.33	61	20	-	0.60
S-G11	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	1.05	77	81	-	2.43
S-G9	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	1.00	79	79	-	2.37
S-Q15	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Ephemeral	Pipeline ROW	0.31	103	32	-	0.96
S-G8	UNT to Jonnikin Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	1.02	90	92	-	2.76
S-A6	UNT to Rocky Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	0.95	20	19	-	0.57
S-H11-Braid	UNT to Rocky Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Ephemeral	Pipeline ROW	0.40	85	34	2.04	-
S-C7	UNT to Rocky Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.18	20	24	-	0.72
S-F2	UNT to Rocky Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Ephemeral	Timber Mat Crossing	0.36	20	7	0.42	-
S-C4	UNT to Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	0.84	58	49	-	1.47
S-C3	Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.12	20	22	-	0.66
S-H13	Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	0.83	77	64	-	1.92
S-G6	UNT to Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Intermittent	Pipeline ROW	0.99	80	79	-	2.37
S-G5	UNT to Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Ephemeral	Pipeline ROW	0.35	77	27	-	0.81
S-G4	Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.22	30	92	-	2.76
S-G3	UNT to Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	0.87	20	17	-	0.51
S-CC16	UNT to Harpen Creek	Pittsylvania	Norfolk	Tomahawk Creek-Pigg River	Perennial	Pipeline ROW	1.15	20	58	-	1.74
S-CC13	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.07	20	21	-	0.63
S-CC14	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.25	20	25	-	0.75
S-MM8	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.17	20	23	-	0.69
S-CC15	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.13	20	23	-	0.69
S-CC5	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Timber Mat Crossing	0.94	54	51	-	1.53
S-CC5	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.13	20	23	-	0.69
S-CC8	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.03	20	21	-	0.63
S-CC9	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.37	81	30	-	0.90
S-CC10	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	0.93	78	73	-	2.19
S-CC11	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.37	87	119	-	3.57
S-MM10	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	0.50	9	8	-	0.24
S-CC1	Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.37	82	112	-	3.36
S-CC3	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.43	91	39	-	1.17
S-P5	UNT to Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.38	20	8	-	0.24

Stream ID	NHD Stream Name	County	USACE District	HUC 12 Name	Flow Regime	Project Activity	Mitigation Scoring				
							Index	Proposed Temporary Impact (Linear Feet)	Unit Score	Existing Temporary Fill Mitigation (5 years @ 3%)	Proposed Temporal Mitigation (1 Years)
S-IJ35-EPH	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.55	171	94	-	2.82
S-Q4	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.17	20	23	-	0.69
S-Q2	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.25	20	25	-	0.75
S-Q3	Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.25	75	94	-	2.82
S-B6	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.55	84	46	-	1.38
S-B8	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.23	82	101	-	3.03
S-B9	UNT to Pole Bridge Branch	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.25	78	98	-	2.94
S-DD4-Braid-1	UNT to Mill Creek	Pittsylvania	Norfolk	Mill Creek-Whitehorn Creek	Intermittent	Pipeline ROW	0.96	67	64	-	1.92
S-DD4	UNT to Mill Creek	Pittsylvania	Norfolk	Mill Creek-Whitehorn Creek	Intermittent	Pipeline ROW	0.96	147	141	-	4.23
S-KL27	UNT to Mill Creek	Pittsylvania	Norfolk	Mill Creek-Whitehorn Creek	Ephemeral	Pipeline ROW	0.38	84	32	-	0.96
S-C1	Mill Creek	Pittsylvania	Norfolk	Mill Creek-Whitehorn Creek	Intermittent	Pipeline ROW	1.10	92	101	-	3.03
S-G2	Little Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.06	20	21	-	0.63
S-B2	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.34	20	7	-	0.21
S-H55	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Ephemeral	Pipeline ROW	0.39	20	8	-	0.24
S-GG11	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Timber Mat Crossing	1.18	46	54	-	1.62
S-H54	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.37	20	27	-	0.81
S-H5	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.37	83	114	-	3.42
S-H3	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	0.75	18	14	-	0.42
S-OO1	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.21	84	102	-	3.06
S-OO2	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Intermittent	Pipeline ROW	1.28	78	100	-	3.00
S-EF26	Little Cherrystone Creek	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Timber Mat Crossing	1.50	20	120	-	3.60
S-H42	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	1.38	20	28	-	0.84
S-H44	NT to Little Cherrystone Cree	Pittsylvania	Norfolk	Cherrystone Creek	Perennial	Pipeline ROW	0.96	33	32	-	0.96

USACE District	Streams			Wetlands		
	Existing Temporary Fill Mitigation (5 years @ 3%)	Proposed Temporal Mitigation (1 Year)	Total Temporal Mitigation	Existing Temporary Fill Mitigation (6 years @ 3%)	Proposed Temporal Mitigation (2 Years)	Total Temporal Mitigation
Huntington	122.49	307.27	429.76	0.3055	0.3615	0.6670
Pittsburgh	25.76	25.06	50.82	0.1122	0.0969	0.2090
Norfolk	76.74	473.34	550.08	0.0251	0.2264	0.2515
Totals	**224.99**	**805.67**	**1030.66**	**0.4428**	**0.6847**	**1.1275**

HUC 8	Stream			Wetland		
	Existing Temporary Fill Mitigation (5 years @ 3%)	Proposed Temporal Mitigation (1 Year)	Total	Existing Temporary Fill Mitigation (6 years @ 3%)	Proposed Temporal Mitigation (1 Year)	Total
Middle Ohio-North	19.06	18.60	37.65	0.0309	0.0377	0.0687
West Fork	25.76	25.06	50.82	0.1122	0.0969	0.2090
Little Kanawha	52.89	44.49	97.38	0.0886	0.0494	0.1379
Elk	21.99	66.62	88.61	0.0322	0.0547	0.0869
Gauley	12.15	117.02	129.17	0.0944	0.1686	0.2630
Lower New	5.62	9.56	15.18	0.0000	0.0091	0.0091
Greenbrier	5.35	17.20	22.56	0.0000	0.0153	0.0153
Middle/Upper New	28.04	106.05	134.09	0.0639	0.0300	0.0939
Upper James	3.30	5.31	8.61	0.0000	0.0000	0.0000
Upper Roanoke	50.82	335.10	385.92	0.0205	0.1606	0.1811
Banister	0.00	60.66	60.66	0.0000	0.0626	0.0626
Total	**224.99**	**805.67**	**1030.66**	**0.4428**	**0.6847**	**1.1275**